CIVIL ENGINEERING

DECEMBER 1954

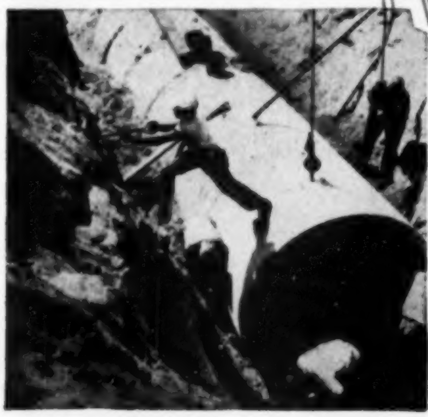
AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

SURVEYING BY HELICOPTER

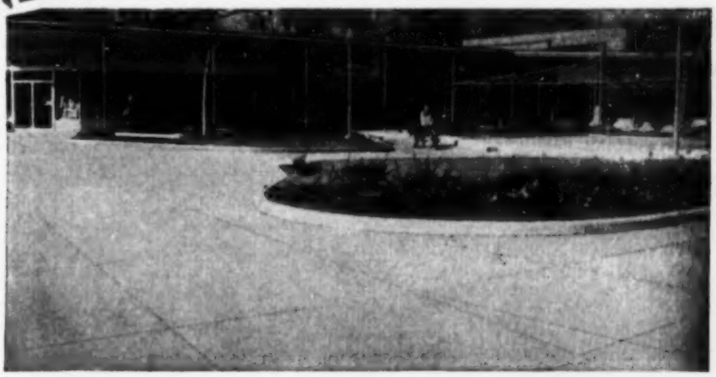
See Article By Gerald FitzGerald

SHORT-SPAN CONCRETE FLOORS in Pittsburgh's new Gateway Buildings are reinforced with American Welded Wire Fabric because it provides the most economical and permanent type of construction.

AMERICAN WELDED WIRE FABRIC reinforced short span floors mean speed in building construction.



HIGH STRENGTH CONCRETE PIPE gives better, longer service when reinforced with American Welded Wire Fabric. Most of the concrete pipe manufacturers use Welded Wire Fabric in the manufacture of their product.



TRAFFIC IS HEAVY and frequent at this new shopping center; but American Welded Wire Fabric Reinforcement keeps walks, curbs and driveways attractive and free from destructive cracking.

Choose American for the strongest and most durable construction

● No worries about the strength and durability of your construction work when you reinforce it with high quality American Welded Wire Fabric. American Fabric doesn't just meet the new ASTM Specifications A185-53T; it often *exceeds* them. It assures you an extra margin of safety in buildings, roads, culverts, sewers, airport runways, and foundation slabs.

We make sure our fabric is the best quality by rigid inspections that check size and spacing of wires, strength of welds, and strength of the finished product. This assures you high-quality construction that is just as strong and crack-resistant as you designed it.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION, GENERAL OFFICES: CLEVELAND, OHIO

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS

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USS

EVERY TYPE OF REINFORCED CONCRETE CONSTRUCTION NEEDS

USS AMERICAN WELDED WIRE FABRIC

UNITED STATES STEEL

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DECEMBER 1954

THE MAGAZINE OF ENGINEERED CONSTRUCTION

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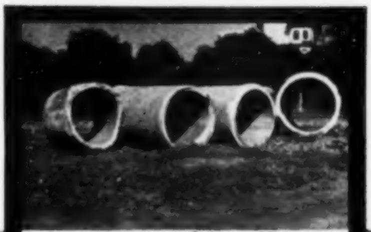
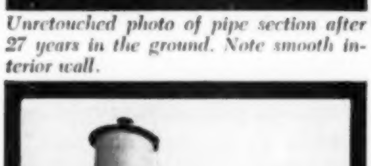


Sections removed from 27 year old Riverside pipeline to accommodate new pumping system.

A PIPELINE–27 YEARS OLD AND BETTER THAN EVER!

Unretouched photo of pipe section after 27 years in the ground. Note smooth interior wall.



Surge tanks at booster station. Automatic controls actuate pump according to water level at intake reservoir weir 7 miles away.

Increased efficiency of American Reinforced Concrete Pressure Pipe is saving $$$ for Riverside

Riverside, California water works engineers devised a method for meeting rising peak water demands by increasing the capacity of a 27-year old reinforced concrete pipe line. The 7-mile 42" gravity line was, and is, a main unit of the city's water supply system. Several sections of pipe were removed to make room for an ingenious vacuum booster system devised by the Riverside men. The centrifugally spun pipe sections, manufactured by American in 1927 and installed with collared joints, were found to be in excellent condition. The steel reinforcement was bright and untarnished, the rugged concrete had improved with age. The interior walls were extremely smooth.

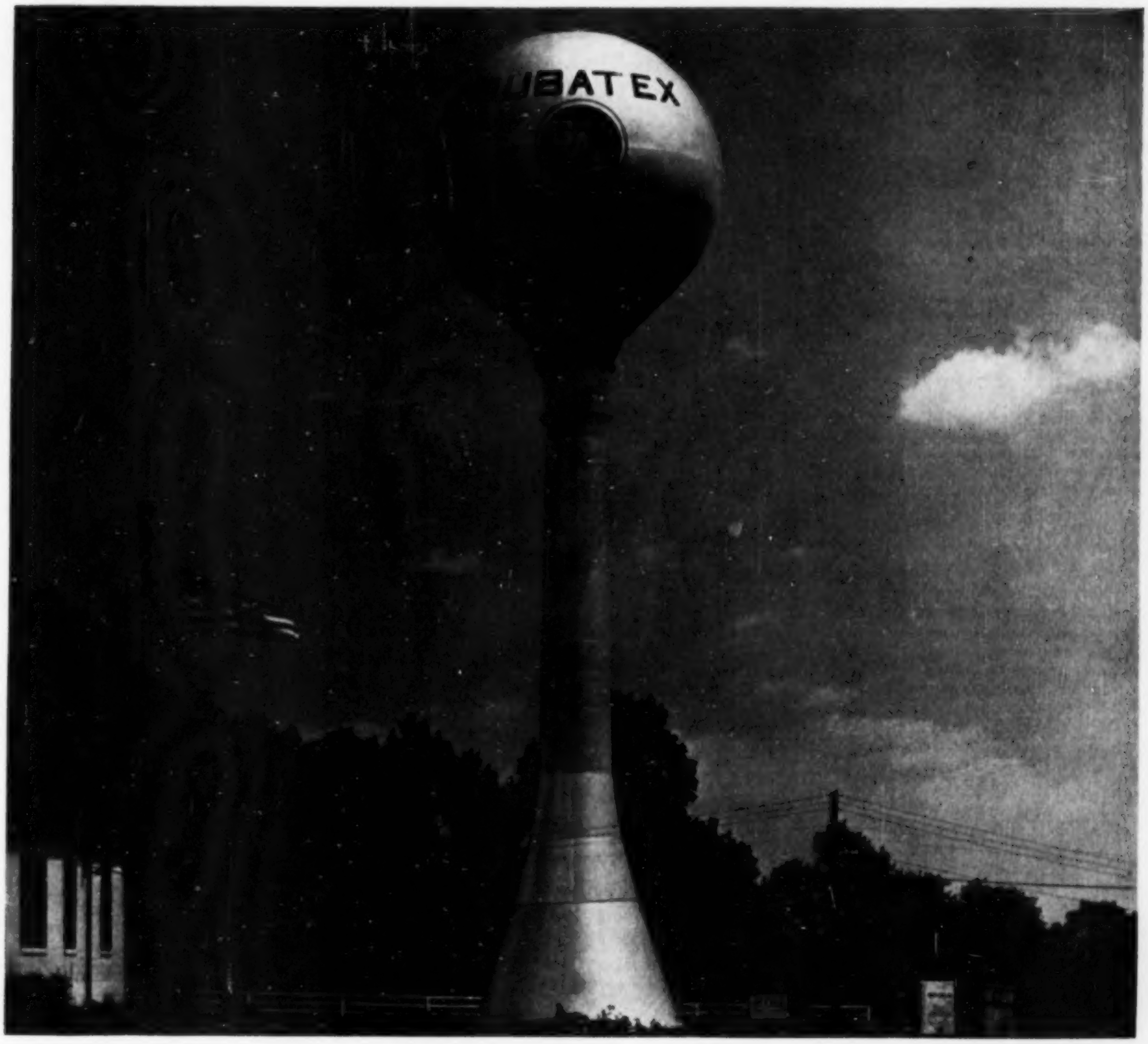
Flow tests conducted earlier had revealed an *increase* in hydraulic efficiency ($C=140$; Hazen-Williams Formula) since the line was installed. Here again is the proof that you can design for a high sustained hydraulic capacity and thereby gain years of extra protection against foreseen and unforeseen increases in demands for water.

The excellent condition of this pipe enabled the Riverside engineers to install their vacuum system and eliminate the need for a parallel line. This resulted in an estimated saving of $650,000.00 to the taxpayers and for many years to come they can enjoy the benefits of a water supply line with costs long since amortized.

The use of American Reinforced Concrete Pressure Pipe in municipal water systems is insurance against large future outlays for repairs, maintenance and high pumping costs. Help on *your* project from our sales engineers and bulletins on American's pressure and non-pressure pipe products are yours for the asking. Write or phone for complete information.

American PIPE AND CONSTRUCTION CO.

Main Offices and Plant: 4635 Firestone Blvd., South Gate, California
District Sales Offices and Plants: Hayward • San Diego • Portland, Ore.
Concrete pipe for main water supply lines, storm and sanitary sewers, subaqueous pipe lines

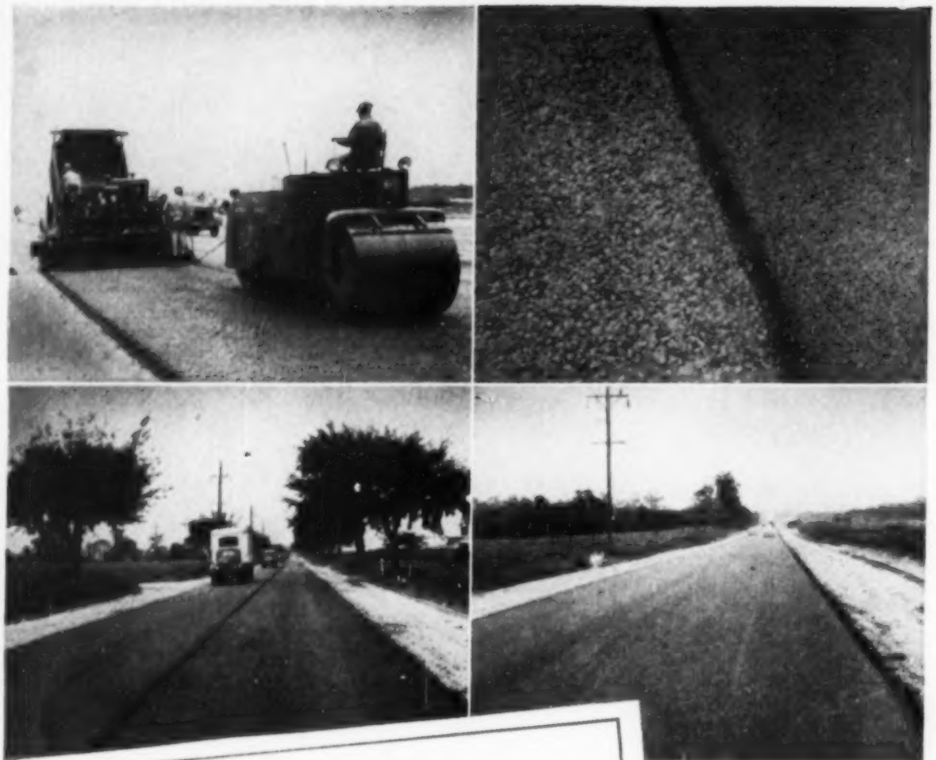

UBATEX

(upper left) **Laying Hot-mix Texaco Asphaltic Concrete over old rigid pavement on Delaware State Route 18.**

(upper right) **Close-up showing the two courses of Texaco Asphaltic Concrete used on Delaware resurfacing project.**

(lower left) **Traffic used the State Highway without interruption while new surface was under construction.**

(lower right) **Section of completed pavement before shoulders received three applications of Texaco Cutback Asphalt.**



Delaware's answer to...

"What thickness of Asphalt is needed when resurfacing old concrete highways?"

CONTRACTOR:
Nello L. Teer Co., Durham, N.C.

When an existing highway of the rigid type is to be resurfaced with hot-mix asphaltic concrete, an important question calling for a decision by the engineer concerns the thickness of the new asphalt surface.

Pictured here is a recent resurfacing project of the Delaware State Highway Department, located on its Route 18. The new Texaco Asphaltic Concrete pavement constructed on this highway was laid in two courses having a combined thickness of $3\frac{3}{4}$ inches.

Sound engineering practice dictates that when a new asphalt wearing surface is laid over an old rigid pavement, it should have a minimum thickness after compaction of $2\frac{1}{2}$ inches to deliver lasting service with lowest upkeep. The thickness to be specified for a particular project must be based on an accurate knowledge of the volume and weight of traffic to be served.

Where necessary, undersealing of the old pavement with asphalt before resurfacing will greatly enhance the performance of the new asphalt wearing surface.

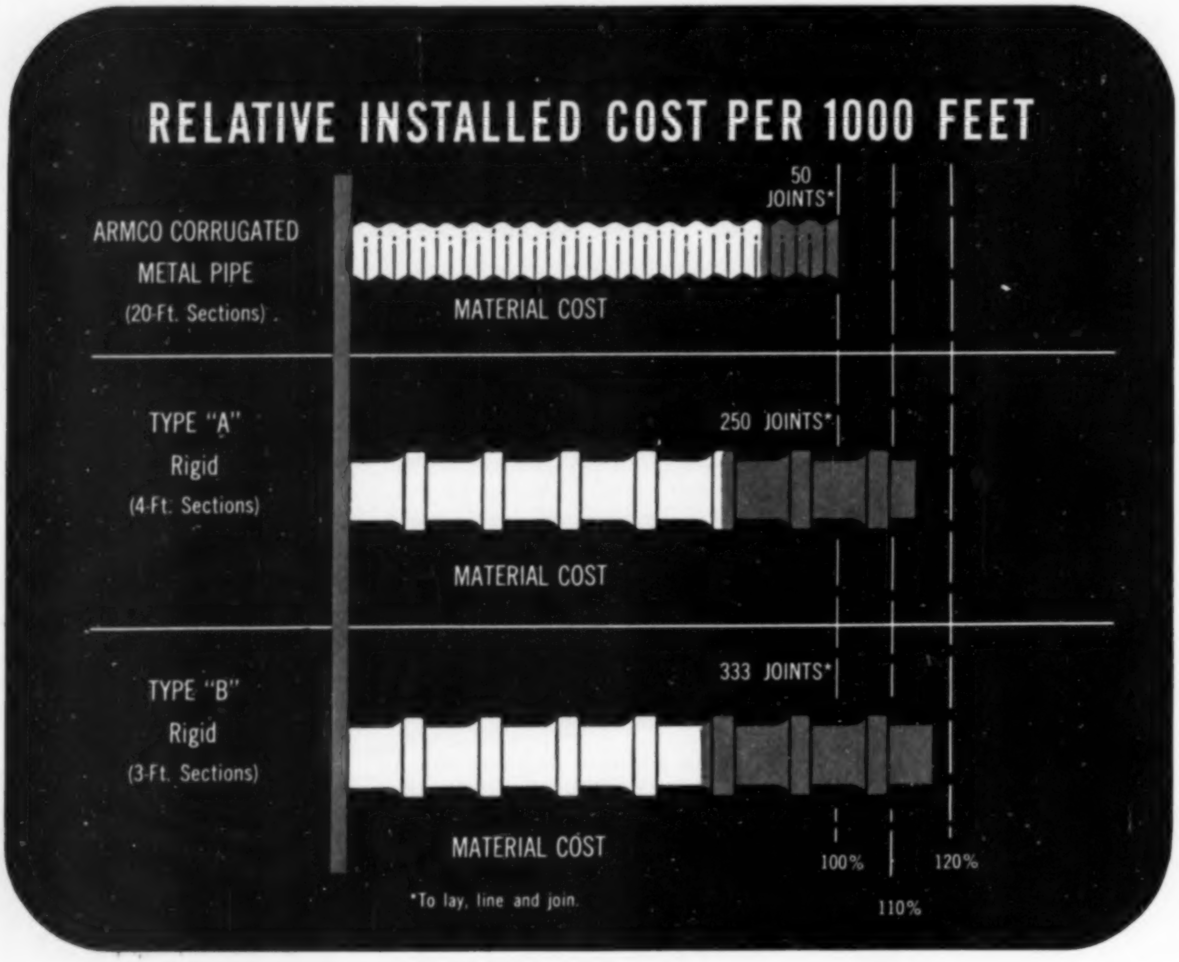
Whatever your street, highway or airport paving problem, there is a Texaco Asphalt Cement, Cutback Asphalt or Slow-curing Asphaltic Oil exactly suited to your needs. These products are used in the construction of Plant-mixed and Penetration Macadam pavements for heavy traffic; low-cost, intermediate-type asphalt surfaces for secondary roads and streets; as well as inexpensive surface-treatments. Helpful information regarding materials and methods recommended for all types of Texaco asphalt construction is provided in two free booklets, which you can obtain without obligation by writing our nearest office.

THE TEXAS COMPANY, Asphalt Sales Dept., 135 E. 42nd Street, New York City 17

Boston 16 • Chicago 4 • Denver 1 • Houston 1 • Jacksonville 2 • Minneapolis 3 • Philadelphia 2 • Richmond 19

TEXACO

TEXACO ASPHALT



How do *YOU* figure drainage jobs?

It's the *installed* cost that counts! And that is where Armco Corrugated Metal Pipe saves you time and money.

Let's see why. Long sections of Armco Pipe, compared to short-section rigid pipe, reduce the number of joints required by 80 per cent or more. There are fewer sections to lay, line and join with no delay for curing. Handling is easier. And thanks to the strength of corrugated metal, there is less chance for breakage. No wonder you can speed the job and save money in the bargain.

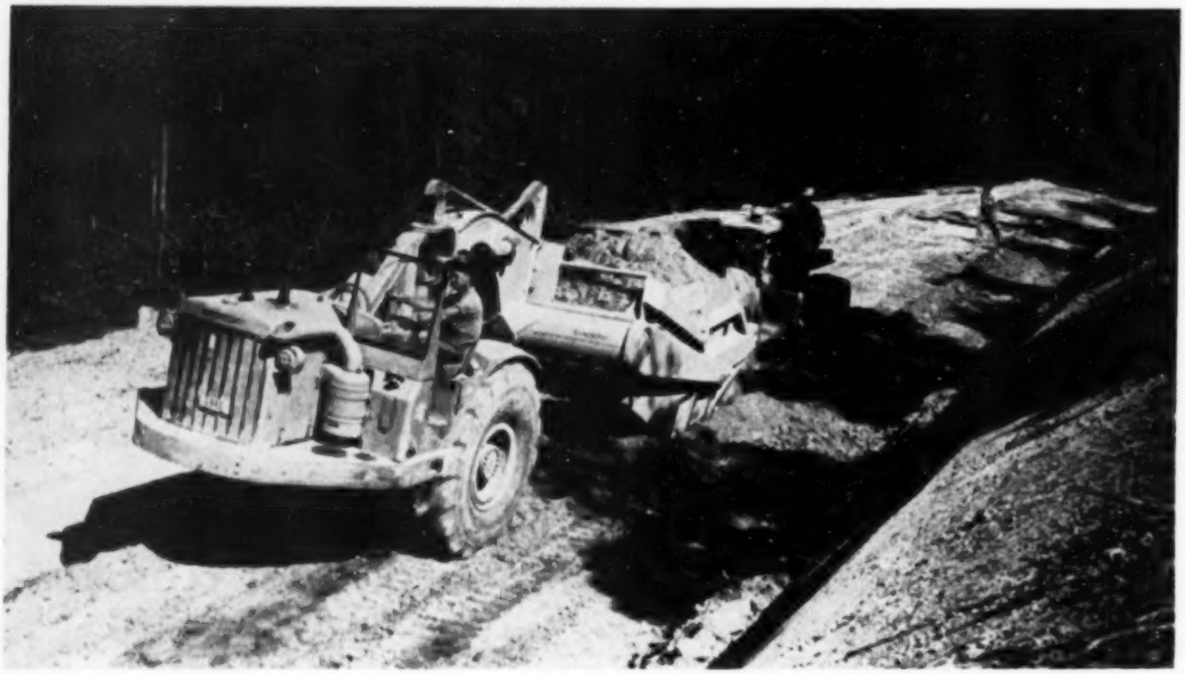
Armco Corrugated Metal Pipe is supplied in diameters from 8 to 96 inches. Lengths range up to 24 feet. Bituminous coatings or Asbestos-Bonded Pipe protect against severe corrosion.

Write for illustrated catalog. Armco Drainage & Metal Products, Inc., 1444 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

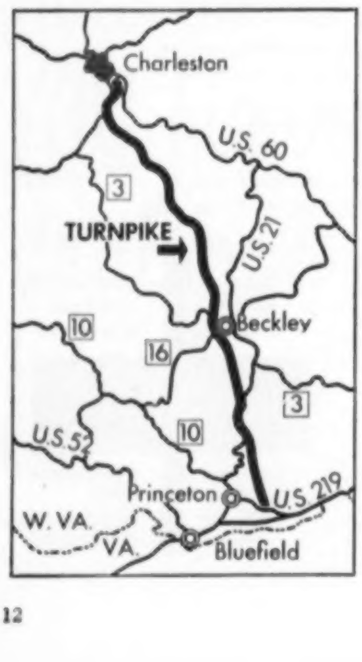
ARMCO DRAINAGE STRUCTURES

West Virginia Turnpike: A Salute to Construction Skill

280 units of CAT* equipment helping contractors complete $100,000,000 job on schedule



A DW21 with No. 21 Scraper, owned by Oman Construction Co., is push loaded on a section of the turnpike near Beckley, W. Va.



The 88-mile West Virginia Turnpike is expected to be ready for use this fall. Built through mountainous country for most of its length, the project has required moving some 31,000,000 cubic yards of earth for fill. During the spring and summer 3,000,000 tons of crushed rock has been spread in a 14-inch blanket, the full width of the grade, and 1,600,000 square yards of concrete paving have been laid.

This huge earthmoving job has been handled fast. During good weather a million cubic yards a week was the regular rate, and a high percentage of the material was rock.

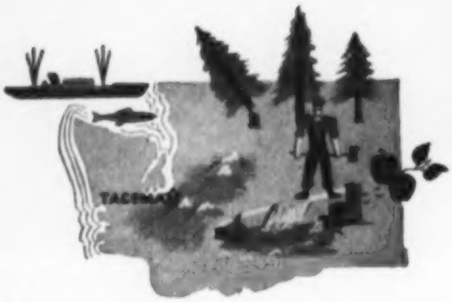
With a maximum grade of 5 per cent, the new turnpike follows the sides of valleys throughout much of its length. The standard roadway is 50 feet wide, but many miles of extra-width grade have been built to take care of future dualization. Starting at 600 feet elevation in the Kanawha Valley near Charleston, the highway climbs to a maximam of 3200 feet at Flat Top, then descends to 2000 feet at Princeton.

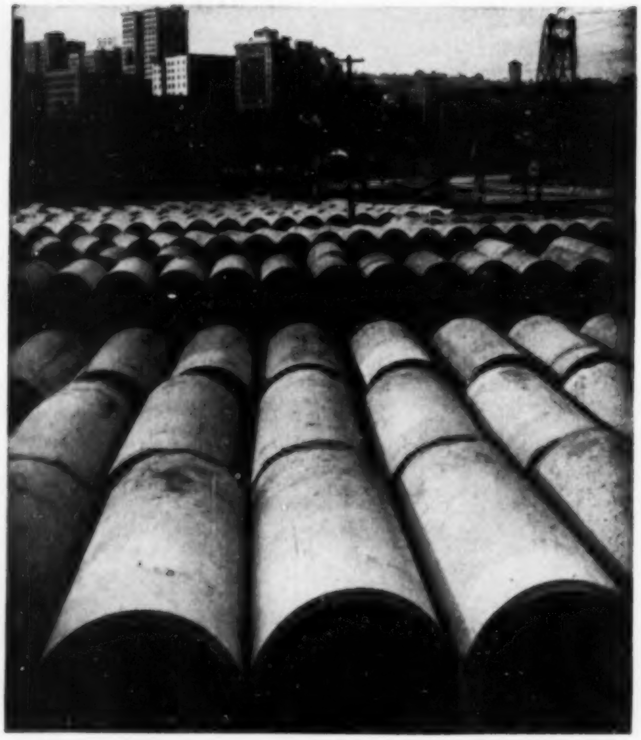
It is expected to cut driving time by half, reducing over a thousand curves in the old road and shortening the distance by 32 miles.

TACOMA

PREFERS

Concrete Pressure Pipe





How does concrete pressure pipe stand up under extraordinary stress? Tacoma water authorities can tell you. Concrete pressure pipe installations in this northwest metropolis have been subjected to unusual strains from vibration, shock, heavy earth loads and serious earth tremors. No damage to the pipe resulted—a tribute to the strength and ruggedness of concrete pressure pipe.

Since 1928, approximately 160,000 feet of concrete pressure pipe have been laid in Tacoma and its surrounding area. Performance reports show that a minimum of maintenance has been necessary; that there has been no trouble due to electrolytic action, corrosion, or tuberculation.

When your community requires water transmission systems or distribution mains which must withstand unusually high stresses, install concrete pressure pipe. It has a proven record of performance under adverse conditions.

Member companies are equipped to manufacture and furnish concrete pressure pipe in accordance with established national specifications and standards.

Concrete PRESSURE Pipe

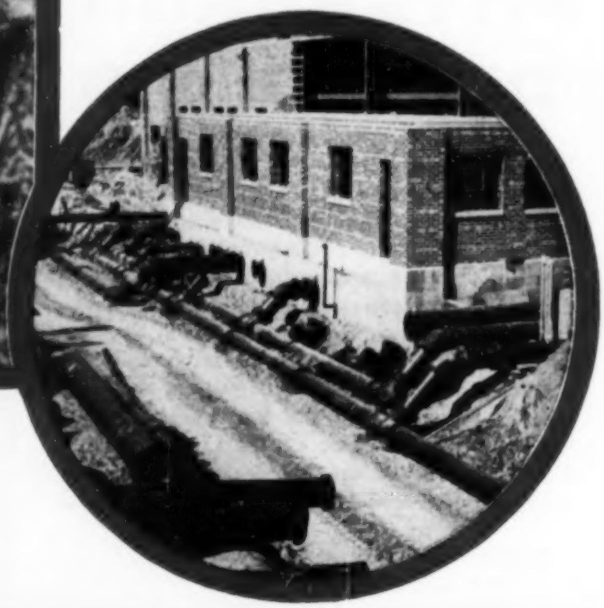
AMERICAN CONCRETE PRESSURE PIPE ASSOCIATION

228 North LaSalle Street
Chicago 1, Illinois

WATER FOR GENERATIONS TO COME

For TOUGH assignments

When pipe is to be installed under conditions which make repairs difficult at best, the engineering profession relies on cast iron pipe. Such installations, for example, as outfall sewers, river crossings, and sealed piping in sewage treatment and water filtration plants. *Any* installation, where repairs should be a remote possibility, calls for rugged cast iron pipe. Its great beam-strength, compressive-strength and shock-strength—plus its effective resistance to corrosion—result in long life with negligible repairs and maintenance cost. For information write: Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Avenue, Chicago 3, Ill.

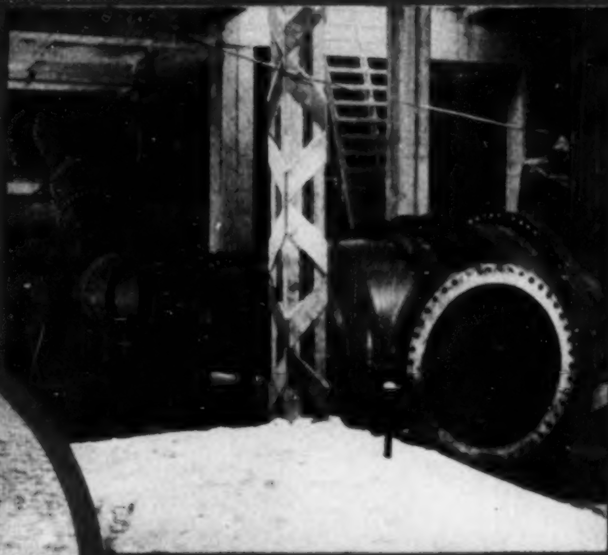


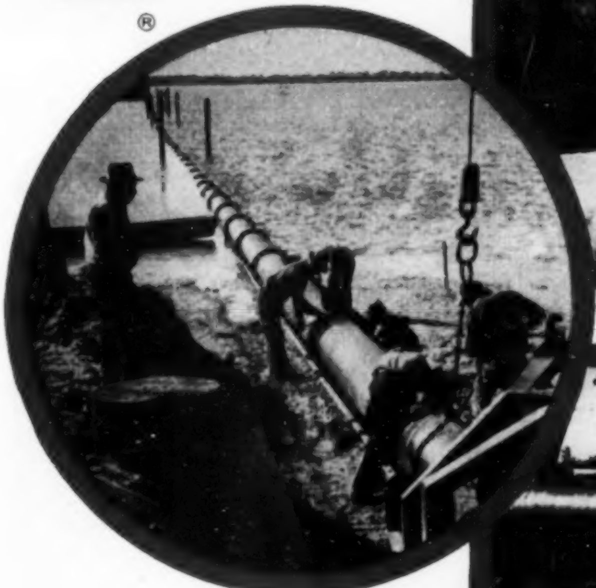
(above)
Installing cast iron belt feeder main for water supply system in Casper, Wyoming.

(right)
Cast iron pipe for discharge lines from water circulating pump house in a midwest oil refinery.

CAST IRON PIPE

use this RUGGED pipe





(above)
Cast iron pipe for outfall into St. Joseph Sound from sewage disposal plant at Dunedin, Fla.

(top right)
Cast iron pipe and fittings installed in world's largest water filtration plant in Chicago, Ill.

(at right)
Installing 30" cast iron pipe for sewage treatment plant at Panama City, Fla.

SERVES FOR CENTURIES...


Good until
2000 A.D.

NEWS OF ENGINEERS

Francis E. Junior, former highway engineer for the U.S. Bureau of Public Roads, Chicago, has joined the consulting firm of Palmer & Baker, Inc., in Mobile, Ala. Mr. Junior has been chief design engineer for the City of Pontiac, and highway and railroad project engineer for the TVA.

G. Donald Kennedy, for the past year and a half executive vice-president of the Portland Cement Association, has been elected president of the Association. Mr. Kennedy, long prominent in the highway and automotive safety field, joined the Portland Cement Association in January 1950 as consulting engineer and assistant to the president. Previously he was vice-president for highway development of the Automotive Safety Foundation.

William Prager, professor of applied mechanics at Brown University, has been invited by the British Institute of Mechanical Engineers in London to give the James Clayton Lecture to the Institute. While in Europe, Dr. Prager will also speak at the Swiss Federal Institute of Technology in Zurich, the Sorbonne in Paris, the Technical University of Delft, Holland, the Imperial College of Science and Technology in London, and the University of London.

Dwight A. Chase, for the past year commander of the Coast Guard Base at Sand Island, Honolulu, is now Coast Guard Chief of Staff. Captain Chase started work for the Coast Guard in 1940. Since then he has received the Commandant's Citation for his fast delivery of navy materials in war theaters and has been chief of civil engineering for the service. In 1950 he was in New London with the Coast Guard Academy as maintenance officer.

Hal H. Hale, for more than ten years executive secretary of the American Association of State Highway Officials, will join the Association of American Railroads where he will assume his new duties as assistant to vice-president P. A. Hollar on January 1. Mr. Hale was city engineer of Knoxville, Tenn., from 1926 to 1938.

William Parker Butler, of Hagerstown, Md., retired recently from the U.S. Bureau of Public Roads after forty years in highway engineering and lightweight concrete work. At various times Mr. Butler was division engineer for the State Highway Departments of Washington, Oregon, Tennessee and Alabama, and for four years was district engineer for the Bureau of Public Roads at Harrisburg, Pa. Mr. Butler saw service in both World Wars and is on the Navy honorary retired list as lieutenant commander.

Past-President Herbert Hoover, Hon. M. ASCE (center), receives the American Institute of Consulting Engineers' Award of Merit from Scott Turner (right), president of the AICE, at the organization's recent annual dinner. Looking on (left) is Alfred P. Sloan, Jr., New York engineer, who was presented the Hoover Medal (see November issue, page 72).

Paul Rice, previously with the Portland Cement Association at Utica, Mich., has accepted a position with the American Concrete Institute as technical director. His new duties will be field and office work to promote and improve technical relations with other societies and organizations. He will be located in Detroit.

John D. Griffiths is the new chief engineer for Gate City Steel, Inc., of Boise, Idaho. During the war Mr. Griffiths served as a Commander with the Civil Engineer Corps of the Navy, and for the past eight years has been engineer for the American Institute of Steel Construction.

J. D. Griffiths

Harold E. Babbitt, professor of sanitary engineering at the University of Illinois and writer of a series of engineering textbooks, retired on September 1. Professor Babbitt, who has held many offices in the Central Illinois Section of ASCE, was formerly vice-president of the National Society of Professional Engineers and a national director of American Public Health Association. He is living in Seattle now.

Kenneth C. Grant and **Edwin L. Bruner** announce that the corporation Grant & Bruner, Ltd., has been dissolved. Mr. Grant will be located at 6039 W. Sixth St., Los Angeles 36, Calif., where he will continue his practice as consulting civil and structural engineer. Mr. Bruner will be at 514 Fremont Ave., South Pasadena, Calif., where he will continue his practice in architecture and structural engineering.

Incentive Awards to USBR Engineers

Seven Bureau of Reclamation engineering specialists and one former Bureau engineer recently received cash awards of $200 each for their work as members of a technical panel on basic design criteria for concrete dams. The men, members of the staff of L. N. McClellan, assistant commissioner and chief engineer at Denver, pooled their knowledge in a study of designing and testing practices, and of behavior records of dams constructed by various agencies. Those honored under the Interior Department's incentive award system are **E. R. Dexter, Robert E. Glover, John J. Hammond, Fairfax D. Kirn, John Parmakian, L. G. Puls, Warren Simonds,** and **Jerome Raphael,** who is now teaching at the University of California.

(*Continued on page 24*)

News of Engineers

(Continued from page 23)

Robert Lawrence Gray has been elected executive vice-president of the Armco Steel Corp. of Middletown, Ohio. Mr. Gray's long career has been spent solely in the steel industry, first with the Valley Steel Co. and the Laclede Steel Co. in St. Louis and then with the Kansas City Bolt and Nut Co. as chief engineer.

William J. Llewellyn has been taken into partnership in the firm of Brian Colquohoun and Partners, consulting engineers of London. His elevation comes in consequence of the appointment of Mr. Colquohoun as engineering adviser to the World Bank, with headquarters in Washington, D.C. An intercontinental engineering firm, Brian Colquohoun and Partners are associated on overseas work with Sir Murdoch MacDonald & Partners of London and Day & Zimmerman, Inc., of Philadelphia.

Arnold R. Smith, formerly with Malcolm Pirnie Engineers and Gibbs and Hill, announces the formation of the Smith & Sobeck Construction Corp., 653 Haddon Avenue, Collingswood, N.J. The firm will specialize in pipeline construction and complicated piping and water projects.

Harry J. Larsen is now head of Larsen Engineering, consulting engineers in Norris, Tenn. His present work includes land surveys, site and subdivision development. He formerly was employed by the Maxon Construction Co.

William W. Brewer is opening an office at 414 Jackson Street, San Francisco, for the practice of foundation engineering and applied soil mechanics. He was formerly with Dames and Moore in San Francisco.

Daniel Noce, Lt. Gen., Corps of Engineers, U.S. Army, retired on October 31 after 41 years of military service. At the time of General Noce's retirement he was serving as Inspector General for the Department of the Army at Hanau, Germany. A graduate of West Point with a civil engineering degree from Massachusetts Institute of Technology, General Noce has been engineer in charge of the harbor defenses at Corregidor, Manila and Subic Bay in the Philippines and engineer officer for the Memphis Engineer District in charge of designing and building the Memphis Flood Control and St. Francis River projects, including the Wappapello Dam. In the recent war he organized and trained the Engineer Amphibian Command, for which he received the Distinguished Service medal, one of many decorations he holds.

Lt. Gen. Noce

Elmer M. Ward, who has been with the Highway Research Board in Washington, D.C., since 1946 as engineer of maintenance, has been named assistant director. For the past five years he has been engineer of materials and construction.

Edward A. Merrill has been assigned as chief engineer for Skidmore, Owings & Merrill in connection with the company's contract as Architect-Engineer for the Air Force Academy at Colorado Springs, Colo. Until recently Mr. Merrill has been associate partner in the organization at Los Alamos, N.M., in charge of construction of the General Laboratory and Administration Building for the Atomic Energy Commission. Earlier in the year he was assistant general manager for Porter, Urquhart, Skidmore, Owings & Merrill, Associated, Architect-Engineers on the construction of air bases in North Africa.

Gordon H. Butler, president of Polaris Concrete Products Co. of Duluth, has just been reelected to the State Senate of Minn. Mr. Butler is a former Director of the Society.

Demetrios A. Polychrone is now an associate professor at the Georgia Tech school of architecture. He will teach courses in structures and act as structural consultant on design problems. Mr. Polychrone has taught at M.I.T. and is a professional engineer in the states of New York and Virginia.

Samuel D. Stickle, until now assistant manager of the Great Lakes Dredge & Dock Co., of New York, has been promoted to vice-president and manager of the company. He will succeed ASCE Treasurer **Charles E. Trout** who has retired (November issue, page 25).

Clayton O. Dohrenwend, head of the graduate division of Rensselaer Polytechnic Institute and former head of the Department of Mechanics, was selected to begin a program of research for the U.S. Navy's Bureau of Yards and Docks. He will investigate the effects of explosive forces. Assisting in the program is **Dr. J. Sterling Kinney,** head of the structural engineering division of the Civil Engineering Department of R.P.I.

John M. Toups, who has been employed by Charles P. Morgan & Associates, Engineers of Long Beach, Calif., has been appointed city engineer for the City of Seal Beach, Calif.

W. Lindsay Suter and **Harold F. Sommerschield** announce the formation of a partnership for the practice of architecture and engineering. The business, to be known as Suter and Sommerschield, will be located at 39 South La Salle Street, Chicago 3, Ill.

John P. Soult, until recently vice-president of the Fruin-Colnon Contracting Co., has been elected executive vice-president. Another vice-president elected is **Oliver A. Ray** who will take charge of the Heavy Division. **Aaron A. Pierson,** formerly district manager, is in charge of the Indianapolis Division and **Robert J. Verner, Jr.,** safety engineer, has been appointed personnel and insurance manager.

Randolph H. Dewante is established in a new office at 2015 J Street, Sacramento 14, Calif., where he will practice sanitary and civil engineering. His offices were previously at 4630 Francis Ct., Sacramento.

Frederick B. Chamberlin, town engineer of West Hartford, Conn., for the past 36 years, will retire at the end of this year. Mr. Chamberlin started work with the town government in 1915 as an assistant town engineer and was appointed acting town engineer in 1933 and manager in 1935. He has also substituted for the town manager during his absences from the city.

Nathan Cherniack is one of four members of the staff of the Port of New York Authority recently awarded its Distinguished Service Medal. On the staff of the Port Authority for the past 31 years, he is regarded as one of the foremost transportation economists in the United States. Mr. Cherniack was president of the Institute of Traffic Engineers in 1951.

Dirk A. Dedel, chief of the Programs Branch, Bureau of Reclamation Region 3, Boulder City, Nev., has transferred from there to the Corps of Engineers, U.S. Army, Philadelphia District. He holds the position of chief of the Programs and Planning Branch of the Operations Division which will be concerned with the planning of the large scale dredging operations starting along the Delaware River from Trenton, N.J., to the Delaware Bay.

(*Continued on page 26*)

News of Engineers

(Continued from page 25)

Louis J. Goodman, formerly on the engineering staff at Lehigh University, has accepted an appointment as associate professor of civil engineering at Syracuse University. His duties will be to develop the soil mechanics and transportation program. Professor Goodman will also be a member of a Geo-Research Team, which handles all types of subsurface problems through the application of geology, geophysics, and soil engineering.

Warren E. Wilson has rejoined the faculty of the South Dakota School of Mines and Technology as professor of engineering education. His work will be to study means of improving the large engineering educational material now available. Dr. Wilson was president of the South Dakota School of Mines and Technology from 1948 to 1953, and in the past year has been director of the Engineering Sciences Division, Office of Ordinance Research, Durham, N.C.

William C. Cassidy, Colonel Corps of Engineers, who has been assistant South Pacific Division engineer, will become South Pacific Division engineer, Corps of Engineers, at San Francisco in December. He will succeed **Col. Paul D. Berrigan,** who has been assigned to the Far East.

Austin H. Downs, general superintendent of the Atlantic Division of the Great Lakes Dredge & Dock Co., New York, N.Y., retired on October 1. Mr. Downs has spent most of his active career with the Great Lakes organization, ending forty years of service with his retirement.

Sam L. Calhoun is now a construction engineer with the Champion Paper and Fibre Co. in Canton N.C. He was formerly employed by the du Pont Co. in Richmond, Va.

Paul R. Watson, associate highway engineer in the Bridge Department of the California Division of Highways, which he joined in 1933, retired on August 31. Mr. Watson has worked as private consultant, county construction engineer, and engineer with the Bridge Department. His notable contributions to the profession include work on the two bridges on Mission Bay in San Diego, the beautiful multiple-arch bridge across the San Luis Rey River near Bonsall, and various major structures in the Los Angeles area.

D. M. Forester, until recently in charge of the Bureau of Reclamation's Yellowstone Projects Office, will now be supervisor and director of the combined Yellowstone Projects Office at Billings, Mont., and the Bighorn Projects Office at Cody, Wyo. Mr. Forester will also be supervising engineer.

Gordon D. Campbell, soils engineer for the Trans-Canada Highway Division, Department of Public Works, Ottawa, has been awarded an International Road Federation fellowship by the Canadian Good Roads Association. He will take the fellowship at Purdue University where he will work toward his Ph.D. in civil engineering.

William E. Potter and **Charles G. Holle,** brigadier generals in the Army Corps of Engineers, have been appointed members of the Mississippi River Commission. General Potter is Missouri River Division Engineer and General Holle is South Atlantic Division Engineer.

Frank L. Ehasz announces the removal of the office of Frank L. Ehasz & Associates from 730 Fifth Avenue, New York City, to their new building near Queens Plaza. The new address is 40-29 27th Street, Long Island City, N.Y.

Marcel M. Fertig, head of the Fertig Engineering Co. and director of Pittsburgh Post, Society of American Military Engineers, has been appointed to the Pennsylvania Board of Arbitration Claims. Mr. Fertig is a consulting civil and structural engineer.

Edward Harold Coe, who retired from the Army in August, has been appointed to the department of civil engineering at the University of Illinois, Chicago Undergraduate Division, where he will be in charge of the civil engineering program. Colonel Coe has been inspector-general at the Engineer Center at Fort Belvoir, Va., and was responsible for construction of the Army procurement, storage and distribution camp at Marseille, France.

Morton I. Goldman, formerly a junior assistant sanitary engineer with the Environmental Health Center, U.S.P.H.S. in Cincinnati, has been transferred to the Oak Ridge National Laboratory. He is doing research on the disposal of radioactive wastes.

New in Education

Georgia Institute of Technology will be host to two meetings early in February. The Georgia State Highway Department and the Institute's school of civil engineering are jointly sponsoring the fourth annual Georgia Highway Conference, February 8 and 9. Scheduled for February 14, 15 and 16 is the fourth annual Quality Concrete School, which will place emphasis on ready-mix concrete.

A Centennial Lecture Series will be part of the 100th birthday celebration of New York University's College of Engineering. Ole Singstad, M. ASCE, New York consultant and tunnel expert, will be one of many prominent engineers and scientists represented among the speakers. The theme of the Centennial is "Teaching and Research Build the Future." Most of the lectures are to be given at NYU's University Heights Center in the Bronx. Further information may be obtained by writing to Centennial Lecture Series, New York University College of Engineering, University Heights, Bronx 53, N.Y.

OHIO TURNPIKE. Max Julian, Angola, Indiana, holder of a 1,000,000-cubic yard earthmoving sub-contract, rates INTERNATIONALS this way: *"My TD-24 powered scrapers can't be beat for production and my 2T-75 high-speed earthmovers are faster, sturdier and haul more weighed yards per trip than any others with the same capacity."*

MAINE TURNPIKE EXTENSION. DeMatteo Construction Co., Quincy, Mass., team these three INTERNATIONAL Model 2T-75s with 8 TD-24s with dozers and scrapers to move 1,250,000 cu. yds. of borrow on 9.145-mile Turnpike contract.

WEST VIRGINIA TURNPIKE. Bates and Rogers Construction Corp., Chicago, find the INTERNATIONAL TD-18A crawler and 3 cu. yd. INTERNATIONAL DROTT Skid-Shovel a great all-around performer in constructing ½-mile tunnel between Standard and Fairfield, W. Va.

WEST VIRGINIA TURNPIKE. Morrison-Knudsen Co., Inc. and R. E. Mills Company, Cabin Creek, West Virginia, used INTERNATIONAL TD-24 to push-load scrapers on a 9-mile contract on the recently opened West Virginia Turnpike.

NEW HAMPSHIRE TURNPIKE. Leveling fill on the New Hampshire Turnpike is a fast moving job with an INTERNATIONAL TD-24 and bulldozer supplying the power. R. G. Watkins & Sons, Inc., Amesbury, Mass., equipment owner.

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From pioneering to paving, INTERNATIONAL equipment speeds the nationwide superhighway projects with lower costs and greater contractor profit.

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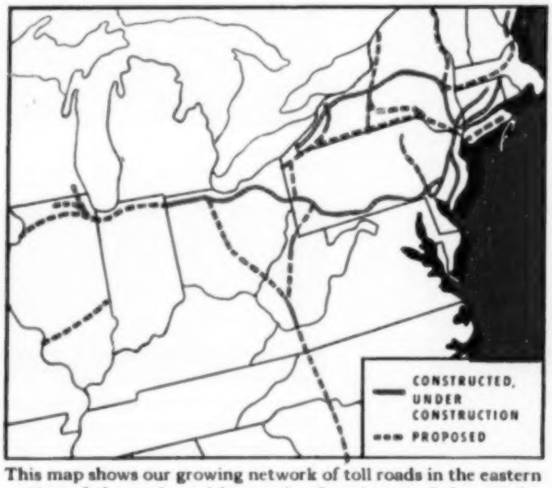
INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS



This map shows our growing network of toll roads in the eastern section of the nation with completed projects and those under construction shown in solid lines, and proposed turnpikes appearing in dotted lines.

INTERNATIONAL HARVESTER

INTERNATIONAL INDUSTRIAL POWER

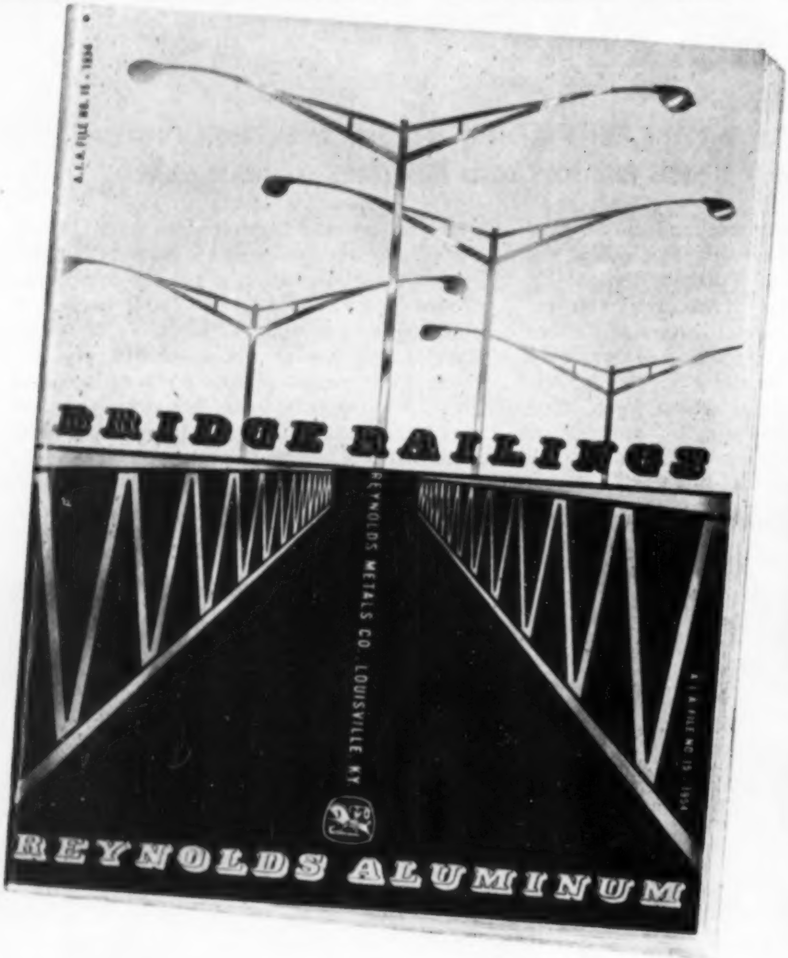
MAKES EVERY LOAD A PAYLOAD

MAINE TURNPIKE EXTENSION. Here are five of the eight INTERNATIONAL TD-24s used by Nello L. Teer Company, Durham, North Carolina, shown loading out the fill on one of the firm's prime contracts totaling 13.48 miles on the Maine Turnpike Extension.

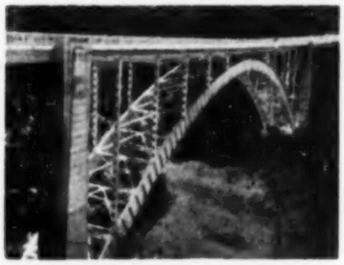
NEW YORK THRUWAY. D. W. Winkelman Company, Inc., Syracuse, N. Y., uses INTERNATIONAL TD-24 to pull elevating loader that keeps eight haul trucks rolling with 400 cubic yards of fill hourly on New York Thruway approach roads.

PENNSYLVANIA TURNPIKE EXTENSION. J. D. Morrissey, Inc., Philadelphia, uses seven INTERNATIONAL TD-24s, two INTERNATIONAL TD-18As on $5,385,313 prime contract for 7½ miles of the Delaware River extension of the Pennsylvania Turnpike.

New Design and Data Handbook on
ALUMINUM BRIDGE RAILINGS



Reynolds Aluminum Railings on Southwest Trafficway, Kansas City, Mo.



Reynolds Aluminum Railings on Pinto Creek Bridge, Globe, Arizona

Reynolds Aluminum Railings, Light Standards and Electrical Conduit Racks on Bay St. Louis Bridge, Miss.

The rapidly increasing preference for low-cost, low-maintenance aluminum in bridge railings makes an up-to-date technical handbook highly desirable. Reynolds new 52-page file size book includes architectural and design criteria, specifications, detailed analyses of typical installations, complete descriptions of available components, surface treatment and insulation. An appendix covers deflection impact, cost studies and the new alloy designation system. For advice on special aluminum requirements, for names of nearest fabricators and for distributors of standard Reynolds mill products, call the nearest Reynolds Sales Office listed under "Aluminum" in classified directories.

For your copy of "Aluminum Bridge Railings," please write on your letterhead to: Architect Service, Reynolds Metals Company, Louisville 1, Ky.

For quick reference, see catalog $\frac{5a}{Re}$ in Sweet's Architectural File.

REYNOLDS ALUMINUM

SEE "MISTER PEEPERS," starring Wally Cox, Sundays, NBC-TV Network.

do you know that

Long strides have been taken toward getting a new Engineering Societies Center Building? The reports of three committees, which have been giving much thought to the problem, and a UET recommendation are summarized in this issue (page 76).

Valuable data on construction equipment performance and costs are being made available in a special "Civil Engineering" series? The series, which begins in this issue with an article on power cranes and shovels by E. O. Martinson, started as one of the Construction Division's most popular Annual Convention sessions.

The Amazon River discharges the largest flow of any river in the world—7,200,000 cfs? You probably do, but do you know that the Mississippi's discharge of 513,000 cfs is only seventh, and that the St. Lawrence (with 400,000 cfs) is tenth in magnitude? For fascinating information on the subject, see "Earth's Grandest Rivers," by Ferdinand C. Lane (Doubleday).

AGC has endorsed the Society's stand on collective bargaining for professional employees? A statement of the Society's policy, which is also the policy of EJC, is given on page 92.

Machine-wise, anyway, man learned to fly before he could crawl? The first practical crawler tractor was introduced in 1904 by the Holt Manufacturing Co., forerunner of the Caterpillar Tractor Co. The Wright brothers had achieved powered flight by 1903.

Our 1955 budget sets a record? At its Annual Convention meeting in October the Board of Direction approved the largest budget in ASCE history for the 1955 fiscal year. A break-down in expenditures, showing how the dues increase permits more effective functioning, is given on page 78.

The prototype power plant for the government's new atomic submarine, the Sea Wolf, was constructed outside its huge steel test sphere and then moved in? The herculean task (smoothly done) of moving the 1,300-ton unit into the shell from its construction site a few hundred feet away is dramatically described by one of the engineers on the project (page 52).

Toll highway projects totaling 1,152 miles in length, are in operation in ten states? Nearly 1,140 more miles are under construction; another 3,700 miles have been authorized for construction; and 2,640 miles are in various preliminary stages of investigation and planning. These figures are from a recent compilation by the National Highway Users Conference.

A $130,000,000 tube will be built across Baltimore Harbor? Maryland has just obtained permanent financing for the construction of a vehicular tunnel under the Patapsco River at Baltimore Harbor by the sale of $180,000,000 of toll revenue bonds. About $130,000,000 will be used to build the Patapsco Tunnel and approaches, and the rest will go to refund outstanding bond issues from the earnings of bridges over the Susquehanna and Potomac rivers and Chesapeake Bay.

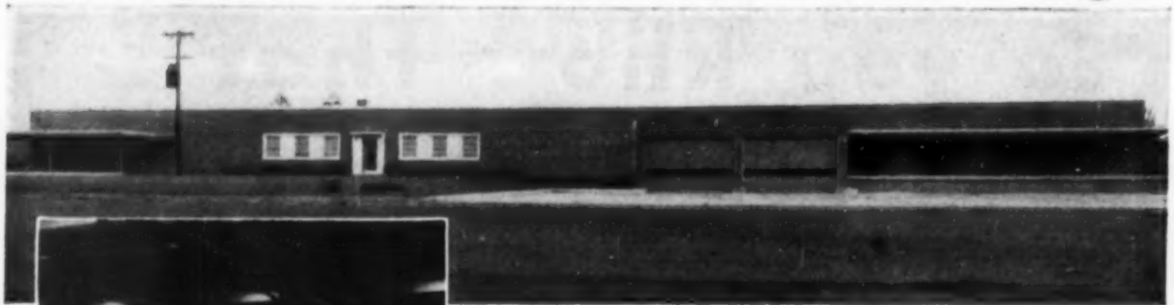
Radioactive aggregate can render concrete structures dangerous to the occupants? So say two engineers in the Oak Ridge National Laboratory, who describe an interesting study on the occurrence of radon in aggregate (page 89).

Atomic and solar energy will supply most of man's needs when other sources of energy are exhausted? This is the opinion of Farrington Daniels, professor of chemistry at the University of Wisconsin, expressed at a recent joint meeting of a French chemical society and the Paris staff of UNESCO. Professor Daniels also said that atomic fuel can supply three million times as much heat as the same weight of coal.

A new Rio Grande dam site has been selected? Selection of a site for the second of three international dams on the Rio Grande is announced by the International Boundary and Water Commission. With the approval of the United States and Mexican governments, the project will be built about fifteen miles upstream from Del Rio, Tex. Similar to Falcon Dam but longer (eight miles to Falcon Dam's five miles), it will be called Diablo Dam. Uses will include flood control, irrigation, and power.

A new volume of "Transactions" is available? New and authoritative opinion on many engineering subjects is yours in the 1954 "Transactions." See "Society News" for details and the advertising section for prices and an order blank.

Concrete Prefabrication Pays



Charlotte Grocers Mutual Warehouse, 60,000 sq. ft. floor area, in "Acres for Industry" development, ten minutes from center of Charlotte, N. C.

Concrete prefabrication is growing by leaps and bounds, thanks to the economies of prestressed concrete members. This well-designed warehouse has precast girders, purlins and roof planks, all prestressed, as well as precast columns, fabricated at assembly-line speed with 'Incor'* 24-Hour Cement.

Designed for the material and method, prefabrication resulted in lowest construction cost, for a structure embodying utmost fire-safety and durability, with minimum insurance rates and lowest upkeep. Advantages well worth considering. *Reg. U.S. Pat. Off.

'Incor' concrete columns, 14" x 14", with 20" x 20" capitals, were precast at job site. Poured in morning, stripped in afternoon—48 columns produced in 12 days.

42 prestressed 'Incor' girders, each 45' long, 30" deep, top flange 12" wide, bottom flange 20" wide, web 5" thick, were cured and stripped in less than 24 hours.

Precast, prestressed 'Incor' concrete purlins, I-shape, 8" wide top and bottom flanges, 3" web, 18" deep, 24' in length, with angles for welding to girders and columns.

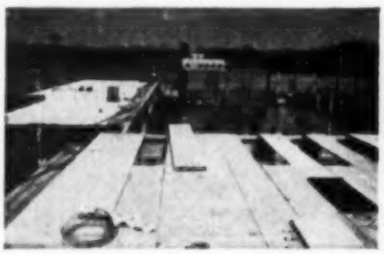
CHARLOTTE GROCERS MUTUAL WAREHOUSE
"Acres for Industry"
Charlotte, N. C.

General Contractor:
J. A. JONES CONSTRUCTION CO.

Architect & Engineer:
J. N. PEASE & CO.

Precast Structural Members and Roof Planks
Ready-Mix 'Incor' Concrete:
CONCRETE MATERIALS, INC.

—all of Charlotte, N. C.



Total of 60,000 sq. ft. precast roof planks, each 1¾" x 18" x 18 ft., were pretensioned at the casting plant. These planks butt together and have recesses for grouting.

At pretensioning bench, 'Incor' concrete produced stripping strengths in 18-24 hours, setting tempo of assembly-line operation as basis of substantial production economy.

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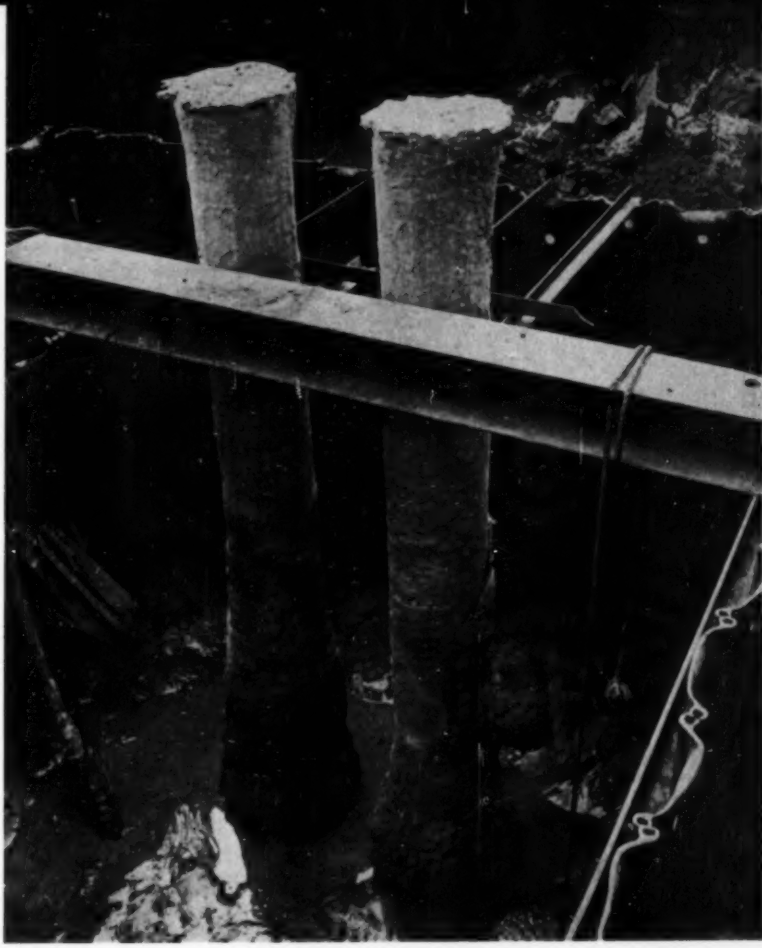
LONE STAR CEMENT, WITH ITS SUBSIDIARIES, IS ONE OF THE WORLD'S LARGEST CEMENT PRODUCERS: 18 MODERN MILLS, 136,000,000 SACKS ANNUAL CAPACITY



COMPRESSED CONCRETE PEDESTAL PILES

form foundation for Corlears Hook Apartment Project

J. H. THORNLEY, M. ASCE, President, Western Foundation Corporation, New York, N. Y.

A pile foundation which is unusual if not unique, from the standpoint of both economy and engineering, has just been completed for the Corlears Hook Apartment House Development at the southeast corner of Manhattan Island, New York, N.Y. (Fig. 1).

This foundation, consisting of nearly four thousand 60-ton concrete pedestal piles, takes full advantage, for the first time it is believed, of the provisions in New York City's revised Building Code (1948) which permit the use of increased loads, up to 60 tons, for non-end-bearing piles where warranted by the results of the boring and test-load program prescribed in the Code. However, in a few recently designed buildings, partial advantage has been taken of the revised Code.

Construction of this privately financed cooperative apartment development is now under way on the Corlears Hook site, which embraces eight blocks lying between the Franklin D. Roosevelt Drive along the East River on the east, Cherry Street on the south, Jackson and Lewis Streets on the west, and Delancey Street on the north. The project is being financed and built by the East River Housing Corporation, initially sponsored by the Ladies Garment Workers' Union. It is not connected with FHA. When completed, it will be entirely owned and operated by the cooperators themselves. The Corlears Hook cooperative is the fourth such venture sponsored by various Needle

Two piles of 60-ton working load, driven to New York City Code requirements, were excavated and removed for observation, as pictured above. Shafts are 17 in. in diameter and pedestals 31 and 30 in. respectively. These unreinforced piles were handled freely by crane without cracking.

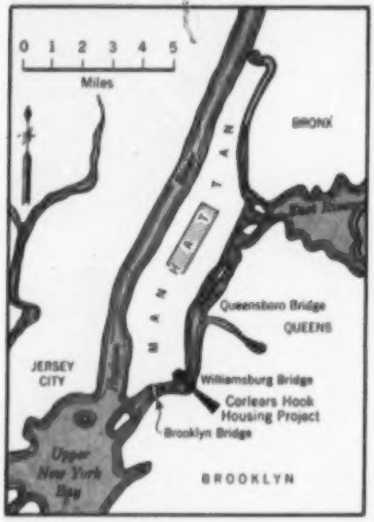


FIG. 1. In Corlears Hook Section of New York, rock is found at depths of 80 to 100 ft. For foundations here described, 21.13 ft was average length of nearly 4,000 compressed concrete pedestal piles placed to support four multi-story reinforced concrete apartment houses.

Trade Unions in the past 27 years. These four ventures have one other thing in common—they have all been fathered, built, and set on their feet as going concerns by the same man, Abraham E. Kazan, whose broad knowledge of every angle of cooperative financing and construction is recognized throughout the United States.

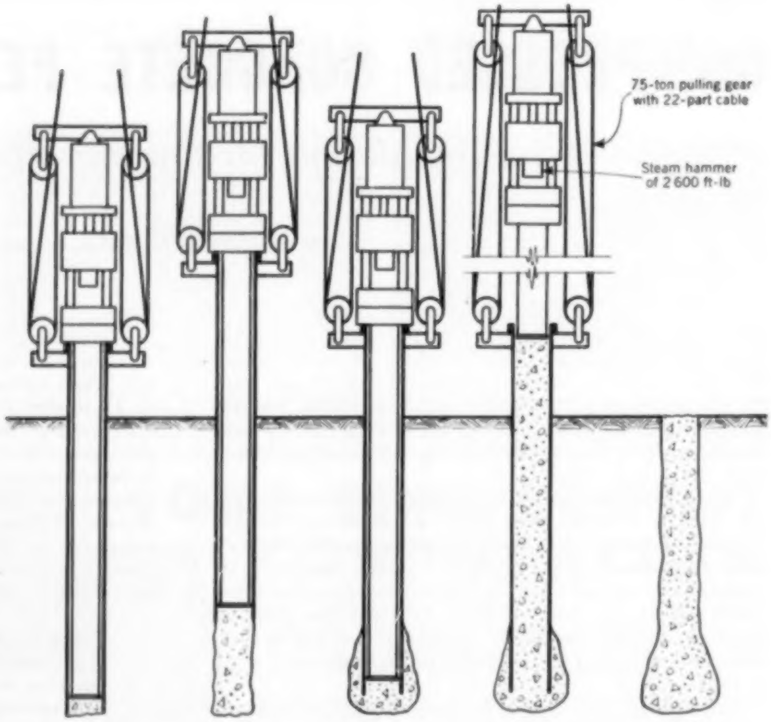
The Corlears Hook project consists of four buildings two of 20-story and two of 21-story height. Since these buildings, in spite of their height, are to be of reinforced concrete construction, the foundation loads are heavier and more concentrated than is usual in apartment-house design.

Subsoil conditions were investigated by borings, which showed rock to be at a depth of 80 to 100 ft, overlaid by sandy soil of potentially good bearing value but of too loose a consistency in the upper strata to support heavy unit pile loads. These conditions indicated the necessity of employing some type of deep foundation. Since experience on other structures in the neighborhood pointed to the use of some type of piling, the designers decided that the best solution to the problem would be to use piles with a high allowable working load per pile.

The design as developed by the engineers, Farkas & Barron, and the architects, George W. Springsteen, and executed by Western Foundation Corporation, called for piles each capable of carrying a 60-ton working load. Many buildings in New York City are carried on piles using a 60-ton working load or more, but up to the time of the introduction of the present New York City Building Code (1948) such loads were permitted only on open-ended steel pipe piles driven to rock. All other types of piles were limited to a 30- or 40-ton maximum load. Because of the depth to rock or to boulder formation over rock at the Corlears Hook site (80 to 100 ft), a foundation of open-end steel pipe piles would have been extremely expensive. The New York City Code as revised in 1948 offered an answer by permitting piles, even though not bearing on rock, to be loaded to a maximum of 60 tons providing they meet the requirements of the stiff test program set up in the Code.

Heavy-duty, 94-ft steel pile-driving rig and 35-ft to 60-ft pile-forming apparatus were required for Corlears Hook project.

FIG. 2. Method of placing compressed concrete pedestal piles is illustrated graphically in five steps. See text for step-by-step description.



New York Code requirements

The Code requirements for the high-load-by-test piles can be summarized as follows:

1. **Permissible loads.** The shaft of the pile when designed as a fully supported column to carry the proposed load must not employ working stresses in excess of 1,000 psi on controlled concrete, or 9,000 psi on steel. For design purposes, the Code requires the load at any section on an end-bearing pile less than 40 ft in length, to be equal to the working load of the pile. For piles longer than 40 ft, driven in soils of any recognized bearing value, the load at the tip of the pile may be considered to be only 75 percent of the full pile load at the butt. On a pile depending on soil friction alone for support, the maximum load must be assumed to be carried to a point one-third of the way down from the top.

2. **Soil borings.** Areas of the foundation site within which the subsurface soil conditions are substantially similar in character, must be established by at least one soil boring for each 2,500 sq ft of building area. Because the Code elsewhere requires at least one soil boring for each 2,500 sq ft of building area on all sites regardless of the type of foundation to be used, the total number of borings required would usually be no greater for a load-by-test pile than for the less heavily loaded pile permitted without tests.

3. **Pile tests.** After the "areas of similar soil conditions" have been determined, at least three piles of the type proposed for the structure must be driven in each such area. One of these three piles must be load-tested; at least one load test must be made for each 15,000 sq ft of building or groups of buildings on the site; and a total of at least two load tests must be made. The permitted design load is: 50 percent of the test load causing a *net* settlement of less than 0.01 in. per ton of test load; or 50 percent of the total test load causing a *gross* settlement of 1 in. or less. *Net* settlement is defined as the settlement remaining after the test load has come to rest and after this load-at-rest has been removed and the pile allowed to recover. *Gross* settlement is the settlement measured after the test load has come to rest but before its removal and the resulting rebound of the unloaded pile.

The test loads are required to be applied in seven equal increments starting at one-half the working load. Each such increment after the working load has been applied is to remain in place for 2 hours after settlement has ceased. If the rate of settlement does not exceed 0.001 ft in 2 hours, the load shall be considered to have come to rest.

The final test load (at least twice the working load) must remain in place for a period of 48 hours during which the settlement must be not more than 0.001 ft.

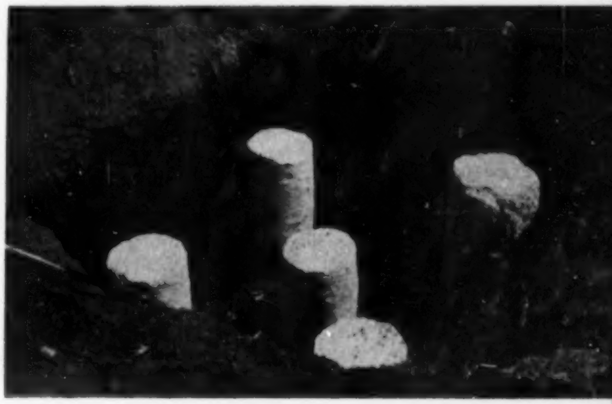
After the load has remained at rest for the 48-hour period, the load must be removed in four equal decrements at intervals of one hour each. Rebound readings must be taken at the end of the hour of rest for each decrement. A final reading must be taken 24 hours after the load has been completely removed.

4. **Group pile tests.** If the Superintendent of Buildings has reason to question the pile bearing values as indicated by the tests, he may require one or more group pile tests to 150 percent of the design working load for the piles.

5. **Additional probings or borings.** In case the lengths and driving conditions shown in each of the three probing piles driven in any assumed area of similar soil conditions are in serious disagreement with the soil conditions as indicated by the borings, additional probings or additional borings may be required by the Building Superintendent.

6. **Pile similarity criteria.** After all tests have been satisfactorily completed for any given area of similar conditions, the piles to be driven in that area must be similar to the load-tested pile. The Code states that this similarity must be shown by two criteria: first, the number of blows per inch of penetration must be as great as, or greater than, the number of blows shown at the conclusion of the driving of the test pile, when using a similar pile-driving hammer operating under similar conditions—that is, steam pressure, length of stroke, hammer control, and condition of the cushion block if used; and second, if the piles vary in length by more than 50 percent from that of the test pile,

New York Building Code requires load test on friction piles. Test load of 270 tons, placed on three piles (each of 60-ton working load) caused permanent settlement of but $^1/_8$ in. after removal of load. Permissible design load is one-half of test load which causes gross settlement of not more than one inch.



Five piles—of 60-ton working load each—are ready for capping to support one building column of Corlears Hook apartment-house project.

the Superintendent of Buildings may require further investigation to determine the adequacy of the piles.

Unusual pile contract provisions

The foundation piling finally adopted was of the compressed-concrete pedestal type. The piling contract was awarded on the somewhat unusual basis of a guaranteed lump sum which was to hold regardless of the depths to which the piles might have to be driven or even the type of pile which might ultimately be selected. In case the proposed type should fail to meet the test requirements of the city's Building Code or the ruling of the Building Superintendent, the contractor took responsibility for making any changes necessary to get acceptance, including the driving of additional piles of lower unit load and the supplying of enlarged caps in case, for any reason whatever, it became necessary to reduce the 60-ton-per-pile load on which the engineer's design was based.

It is obvious that, working under such an agreement, the contractor could not afford to take the smallest chance of failure to meet any Building Code requirement or even of approaching the permitted test-pile settlements.

After the contract was awarded, a six weeks' preliminary test program was completed before moving into the pile area of the site. Piles were driven to various depths—with various sizes and shapes of pedestals, in groups and singly—and a number of test loadings were made to ascertain the most effective use, the most economical form of pile, and the best procedure to be followed in installing such piles. The results of all the load tests made on the site are given in Table I.

Under the Building Code, the test piles would have been acceptable had they shown a net settlement of 1.2 in. or less. The maximum net settlement under twice the 60-ton working load actually was 9/64 in. with an average *net* settlement of 7/64 in., which is but one-eleventh of the net settlement permitted by the Code.

Regardless of the working load proposed for a pile, the *gross* settlement before the release of the test load must not exceed one inch. This works a hardship on any pile exceeding a 50-ton working load since the gross instead of the net settlement becomes the governing condition, and the gross settlement must always exceed the net settlement. The test results at Corlears Hook show a maximum gross settlement under double the 60-ton working load, before release of the test load and recovery of the pile, of but 1/4 in. This is one-fourth of the gross settlement permitted by the Code.

The uniformity of the results is probably the most unusual feature of these tests, which were triple checked on every measurement by the City Building Department, the engineer, and the contractor. Two independent methods of measurement were used on every reading. The first was by instrument and the second by direct reading on piano wires tightly stretched between posts which were referenced in by instrument readings to permanent bench marks. It is reasonable to assume that not even a hair crack will ever result from foundation settlement in this structure.

In its basic form there is nothing new or untried about the compressed concrete pedestal pile—a cast-in-place pile with a compressed concrete shaft and a pedestal base, in which the unset concrete is placed in a steel shell which is pulled out after placing. This type of pile has been in use for over forty years, and probably has been employed on at least as many piling jobs as any other cast-in-place pile type. Speaking geographically, this type has been far more widely used, except in the United States, than all other cast-in-place concrete pile types combined. The principal proponent of this basic type has been the Franki Pile Company and its affiliates, but they are not by any means the only users. Other variants of the same general type have been introduced and widely used by the MacArthur Concrete Pile Company, the Vibro Pile Company, and the Western Foundation Corporation.

The compressed pedestaled type of pile is well adapted to heavy unit pile loads. In its use throughout the world it has generally been installed for working loads of 90 to 120 tons per pile. The process of installation is rather slow, and it does not cost a great deal more to produce a pile with a 100-ton capacity than one with a 30-ton capacity.

In the matter of material cost, the reduction in working load for a compressed concrete pile does not show a proportionate reduction in cost. With the reduction in the diameter of the tube, the internal friction increases rapidly so that arching and locking of the concrete in the tube has generally prevented the use of such piles when less than 14 in. in diameter.

Plant and method

Immediately following the award of the contract for the Corlears Hook job, the first pile-driving rig was installed on the site. This rig and the others subsequently used, consisted of heavy-duty steel pile drivers having a clear height above ground and under the headblocks of 94 ft. They were equipped with pulling gear for extracting the forming casing and ejecting the concrete, rated to develop a pull of approximately 75 tons.

The drivers carried specially designed single-acting steam hammers developing an impact of 26,000 ft-lb per blow—almost twice that of the more generally used No. 1 Vulcan with its rated 15,000 ft-lb per blow.

The apparatus and the step-by-step procedure used on this job for forming the pile are shown in outline in Fig. 2.

Step 1. The forming apparatus consists of a steel casing pipe which may be between 14 and 20 in. in diameter and from 3/8 to 1 in. in wall thickness. Within the casing there is a steel core about 6 in. shorter than the casing and having its lower end closed by a steel base closely fitting the inside diameter of the casing. The

TABLE I. Record of load tests on 16-in. compressed pedestal piles with 60-ton working load

	Settlement at 60-Ton Working Load, In.	Test Load, Tons	Gross Settlement, In.	Net Settlement, In.
1 pile in typical 6-pile group	3/64	122	1/4	3/32
3-pile group	7/64	270	9/32	1/8
Single pile	1/16	123	1/4	1/8
Retest of above pile	Test started at 120 tons	180	11/32	3/32
Building No. 1: Footing 217, Pile 5	1/32	122	9/64	3/64
Building No. 2: Footing 40, Pile 3	1/16	123	1/4	1/8
Building No. 2: Footing 236, Pile 4	1/16	123	1/4	1/8
Building No. 3: Footing 11, Pile 4	3/64	123	1/4	1/16
Building No. 3: Footing 222, Pile 4	1/32	123	7/32	7/64
Building No. 4: Footing 11, Pile 3	3/64	123	1/4	1/16
Building No. 4: Footing 71, Pile 4	1/16	123	1/4	3/64

space between the bottom of the core and the bottom of the casing is completely filled with a plug of concrete. The core, the casing, and the concrete plug are together driven into the ground to a predetermined depth or resistance.

From Step 1 to Step 2. The core is removed from the casing, leaving the bottom of the casing sealed by the concrete plug. A charge of very dry concrete, usually 6 to 12 cu ft, is deposited in the casing. The core is replaced in the casing with the core base in contact with the top of the concrete. The pulling gear is then operated, forcing the core down against the concrete and simultaneously drawing the casing up over the concrete till the core head is in contact with the top of the casing, as shown in Step 2.

From Step 2 to Step 3. The hammer is put in operation and core and casing together are driven to slightly above their original position, thus forcing a pedestal of concrete out sideways against the soil to the position shown in Step 3. The amount of concrete used for the pedestal may be varied either by changing the volume of the first "shot" or by repeating the pedestaling operation two or more times. Sufficient concrete is forced out so that the resistance to driving will be as great as, or greater than, the resistance shown by the load tests to be sufficient to meet test-load settlement requirements.

From Step 4 to Step 5. The core is removed and the casing filled with a sufficient volume of very dry, coarse concrete to form a pile shaft of the required diameter, a diameter always in excess of the outside diameter of the casing, and of a length extending from the bottom of the casing to the cutoff elevation of the pile. The core is replaced in the casing with its base in contact with the top of the concrete and the casing is extracted, the core taking a part or all of the stress of the pulling through the concrete to compact the concrete against the surrounding soil and to form a shaft of at least the predetermined diameter, as shown in Step 5, which represents the completed pile.

The shaft of a cast-in-place concrete pile, whether it is formed with or without a permanent shell, must meet three basic requirements—freedom from squeeze, continuity of shaft, and freedom from admixture of soil or water with the concrete forming the shaft.

First, it must have sufficient resistance to crushing to prevent movements of the surrounding soil from distorting the shaft. In the case of a compressed concrete pile, this resistance to distortion is obtained by forming the shaft of a rough, dry, highly compacted concrete which when deposited, before even the initial set has begun, will have a far greater density and therefore a greater resistance to distortion when in place, than the surrounding soil which acts as the form for the concrete. To force such a concrete through a tube of 15-in. inside diameter, such as was used on this work, and 20 to 60 ft long, demands a good deal of power. This explains the requirement for 22 parts of cable in the pulling gear. Frequently even this gear does not supply sufficient power to keep the column of unset concrete in motion and the internal friction becomes so great that the concrete locks in the casing. When this occurs the pull is maintained at its maximum and the steam hammer, mounted on the core which in turn bears on the concrete, is put into operation to overcome the friction and force the concrete through the casing.

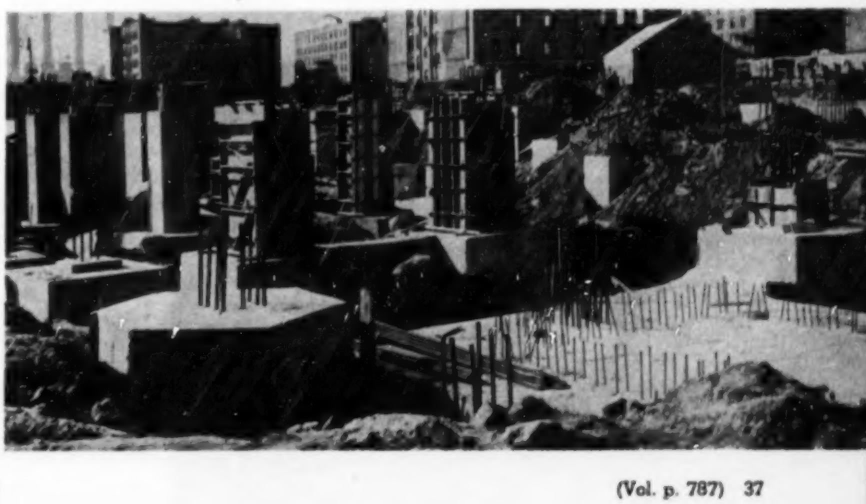
A column of concrete formed in the ground in this manner cannot be squeezed by the driving of adjacent piles because the soil surrounding it has less density or resistance to distortion than the concrete forming the column. Neither soil nor any other substance under pressure will flow into an area of high pressure or density, when an area of lower pressure is open to it.

Second, the shaft of any pile must be of a certain minimum cross-sectional area at all points of the pile and must be free from any discontinuity or separations. The method used at Corlears Hook, as previously described, eliminates this danger of a discontinuous shaft.

Where pressure is to be exerted on the concrete during the extraction of the casing from the ground, there must be some means of synchronizing the upward movement of the casing with the downward movement of the core. If at any time during the extraction of the casing the core does not move down, then the size of the shaft formed will be less than the outside diameter of the casing pipe.

The method used at Corlears Hook avoids the possibility that no concrete will be deposited or that concrete in the shaft will not be under pressure, for even the shortest segment of the pile being formed, by the simple method of carrying the stress of extracting the casing back through the core, which in turn is resting on the concrete. If the concrete ceases to be deposited under pressure, the whole process is instantly and automatically locked. The pressure of extracting the casing cannot be carried through a void any more than a man can lift himself by his own boot straps.

There is one other possibility which must be automatically guarded against. The pressure required to extract the casing may at times be so great when applied to the column of concrete (via the yoke transmitting the pulling load to the core and through it to the concrete) that a shaft of unnecessarily large diameter, or even a large bulb of concrete, might be formed. To avoid this contingency, a device is provided which allows a part of the pressure of extraction to be taken by the ground,



Piles and caps cover most of foundation area, even using 60-ton piles spaced 3 ft on centers. With more usual 30-ton piles, closer spacing of piles and increased cap size would have presented a problem, and cost would have been excessive.

through the frame of the driver, but this device can operate only when the amount of concrete deposited exceeds by a certain predetermined amount the quantity needed to form a shaft of a diameter greater than the outside diameter of the forming casing.

On the Corlears Hook job, the smallest average diameter of pile shaft shown by several thousand piles partly exposed by the excavation was slightly in excess of 16 in., and the maximum diameter was 17 in.

Third, throughout the process of forming a cast-in-place concrete pile, whether cased or uncased, all soil must be excluded and the amount of water entering must be no more than can be bailed out, so as to assure that the concrete will be deposited in the dry and that water entering the forming casing or the permanent shell during or after the deposit of the concrete will not be under such pressure as to permit it to boil up through the unset concrete.

The casings used for forming compressed concrete piles have a wall thickness of $^3/_4$ to 1 in. so that they will stand up under very rough driving conditions. The bottom of the casing when driven is closed with a concrete plug which is driven up against the closed-end bottom of the core. This plug remains in place till a charge of stiff concrete has been deposited above it in the casing and has been compressed under the driving action of the hammer. Water even under high pressure will not percolate through the compressed concrete of the pedestal and shaft.

Reasons for cost savings

In all, 3,784 compressed concrete pedestal piles, of 60-ton working load each, were driven on this project. The cost of the piles and caps ran into a very substantial figure. The cost of the piles alone was approximately

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REINFORCED CONCRETE BUILDINGS 20 STORIES HIGH

MAURICE BARRON, M. ASCE, and NICHOLAS FARKAS
Farkas and Barron, Consulting Engineers, New York, N.Y.

Below:
All four buildings in Corlears Hook Project are in shape of triple cross in tandem. Structural Engineers are Farkas and Barron. Architects are the late George W. Springsteen and Herman J. Jessor, associate.

Below Right:
FIG. 1. Two 20-story and two 21-story buildings cover 19 percent of site at Corlears Hook cooperative housing development.

The tallest buildings so far erected of reinforced concrete using flat-slab construction are going up in lower Manhattan, New York. The Corlears Hook housing project consists of two 20-story and two 21-story buildings situated on a site of approximately 13 acres, just south of the Williamsburg Bridge at Grand Street, fronting on the Franklin D. Roosevelt Drive and the East River. The site affords a panoramic view of the surrounding area for miles in all directions, as these buildings will tower over the bridge approach and the adjacent housing projects.

This project is the first slum-clearance redevelopment in the city to go under construction under Title 1 of the National Housing Act of 1949. Under this title the site, which was occupied

$500,000. The caps were placed under a separate contract with another firm.

The exceptionally low cost of this work is a direct result of three special features of the design:

1. The use of 60-ton closed-end friction piles permitted by the most recent New York Code instead of the 30-ton piles previously required and still generally used. The savings under this head do not stop with the reduction in the number of the piles. An almost equal saving, percentage-wise, will result from the reduction in the size and number of pile caps. In cap design, the governing factor is the bending moment, not the punching shear of the pile, and the increased pile load will be offset by the reduced lever arm of the outside piles in the smaller group. A secondary though less easily figured saving arises from the greater freedom of design allowed by the reduced size of the pile groups. As shown in the photographs of the foundation, the column spacing was close, around 16 ft × 16 ft, and twin column caps requiring up to fourteen 60-ton piles were fairly numerous. A design based on 30-ton piles would have been very expensive if not impossible.

2. The adoption of pedestal-type piling, which reduced the required average penetration of the piles from around 50 ft to 21.13 ft.

3. The use of an uncased and compressed-concrete pile shaft instead of a cased shaft. The highly compressed concrete shaft adds to the compaction of the soil, which is a prime factor in the bearing value of any type of pile.

Considering the savings and the design advantages, it seems surprising that greater use is not being made of the permissible high-load piles, both in New York City and in the many other cities which now have similar code provisions.

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primarily by substandard fire-trap tenements, was acquired by the city and resold to the developer at about $2 per sq ft. The difference between this price and the original purchase price is borne jointly by the city and the Federal Government, with the city paying one-third of the difference and the Federal Government the remainder. The developer has resettled, at his expense, 878 families occupying the slum area and has also borne the cost of demolition of buildings and rerouting of utilities due to the closing of streets. This housing is for the lower middle income group; apartments rent for an average of $17 per room. It is a cooperative undertaking, and the tenant cooperators are required to invest $625 per room.

A non-profit venture

The developer and builder of this cooperative venture is the East River Housing Corporation, and the project is being sponsored jointly by the United Housing Foundation and the International Ladies Garment Workers' Union. The site was originally selected by the Committee on Slum Clearance, of which Robert Moses is chairman, and Philip J. Cruise, chairman of the New York City Housing Authority, is a member.

The East River Housing Corporation, of which A. E. Kazan is president, is a non-profit cooperative housing group organized under the Redevelopment Companies Law of the State of New York. The group is an outgrowth of the cooperative which constructed three other large-scale developments—the Amalgamated Dwellings and the Hillman Houses on Grand Street, and the Amalgamated Houses in the Bronx.

The total cost of the project is about $20,000,000. It will provide 1,668 apartments with 5,900 rooms in the four buildings, an average of 21 apartments to the floor. The buildings occupy only 19 percent of the site (Fig. 1). The remainder provides for parks, playgrounds, and outdoor parking for 350 cars. There is also a one-story central heating plant to service the four buildings. Each building has a typical floor area of 24,000 sq ft (Fig. 2), making a total of 1,900,000 sq ft in the four structures. As a part of this project, a shopping center will be built to provide the commodities and services required by the project and the neighborhood.

This project presents many unusual features of design, both architectural and structural. Economy of construction without sacrifice to apartment layout was a primary objective, which has been achieved by utilizing the minimum service area—public halls, stairs, elevators, and incinerators—for the apartments served. See Fig. 2.

Elevators (two in each bank) stop on alternate floors, thus saving the cost of one-half of the door assemblies. Three banks of elevators service each floor. Whenever possible, kitchens are adjacent to bathrooms or bathrooms are adjacent to bathrooms, thereby effecting economies in plumbing lines.

Apartments well arranged

The layout (Fig. 2) provides effective cross-ventilation and privacy in each apartment. Kitchens and dining alcoves are sized and arranged for efficient use, with windows to the outer air for kitchens to afford a cheerful atmosphere for living and working. The apartments are spacious and provide more room than is generally found in projects of similar type. There is ample closet space and all rooms open off the foyers, which are roomy. The kitchens and bathrooms are all on the outside, with daylight lighting, except in efficiency apartments. The three-bedroom apartments have two bathrooms. Each building has three entrances for quick and easy movement to streets and parking area.

Generous areas in the lowest floors of each building, which are completely above ground, provide recreation and community rooms for adolescents and adults, besides a nursery. Facilities for storage of carriages, bicycles, and general-purpose rooms are also provided. The buildings have modern coin-operated laundry rooms with driers and extractors for the convenience of tenants. Each wing has its own mail room and incinerator. One building houses administrative and management offices.

Each building is in the general shape of a triple cross in tandem, symmetrical about the center line. The overall length of the building is 311 ft and the width of the two outer crosses is 127 ft 6 in. Each building has 12 separate balconies on each floor, or a total of 946 balconies and 36 terraces. In addition, eight bay windows on each floor enhance the beauty of the building and provide large glass areas for the spacious living rooms.

All floor slabs are flush top and bottom. Floors for living areas are of parquet wood on mastic. Kitchens have a troweled finish to permit placing of linoleum of the tenant's choice. Bathrooms have ceramic tile floor and base, and public halls have asphalt tile floors. The main lobby has a terrazzo floor and base.

Scissor-type stairs of all-concrete construction are used. The cost of a pair of such stairs compares favorably with

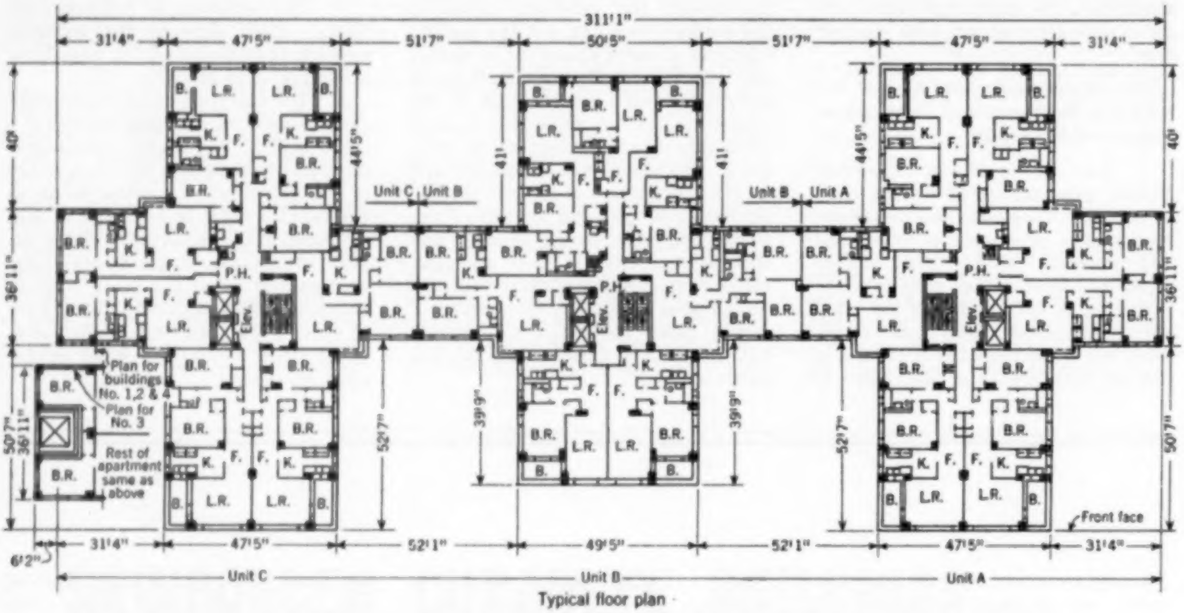
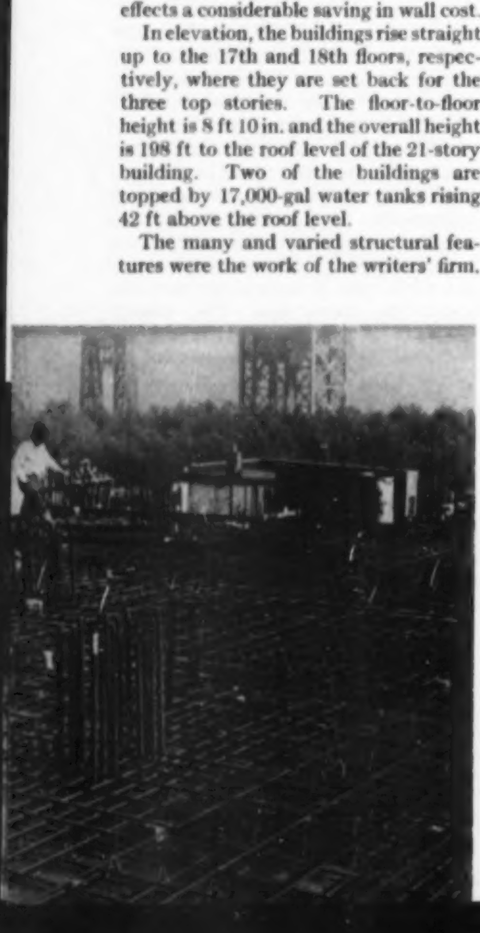


FIG. 2. Typical floor plan shows irregular column arrangement permitting maximum latitude in apartment layout.

the cost of one platform stair. Double-hung aluminum windows reduce maintenance costs. The use of cavity wall construction of 4-2-4- type eliminates furring on the inside face of the wall and effects a considerable saving in wall cost.

In elevation, the buildings rise straight up to the 17th and 18th floors, respectively, where they are set back for the three top stories. The floor-to-floor height is 8 ft 10 in. and the overall height is 198 ft to the roof level of the 21-story building. Two of the buildings are topped by 17,000-gal water tanks rising 42 ft above the roof level.

The many and varied structural features were the work of the writers' firm.



Fourth-floor deck is ready for concreting. Note simple pattern of flat-slab reinforcement and electric conduits running to tubular distribution boxes. Williamsburg Bridge is in background.

The economy of design may be gaged by the fact that the unit price for the structural concrete work was \$2.17 per sq ft of floor area, including finished ceiling ready for painting—a very low figure at today's prices. A good part of this low cost was due to careful design of reinforcement, averaging only 5.4 lb per sq ft, low for a 20-story structure.

Studies and designs were made and plans prepared for both lightweight concrete and stone concrete, and bids were obtained on both types. The studies indicated a possible saving in the pile foundation of \$120,000 by the use of lightweight concrete, but the cost of the superstructure would be higher. The saving in reinforcing steel was estimated to be only 0.28 psf of floor area, while the extra cost of the lightweight aggregate, plus the cost of the required screed coat, more than offset this saving. Actually, the added cost for the lightweight frame came to \$88,000, or 4.6 cents per sq ft, so that the net saving in foundations amounted to only \$32,000, or \$8,000 per building. This small saving, coupled with the difficulties experienced in obtaining consistently high-strength concrete with lightweight aggregate on another project, resulted in the selection of stone concrete.

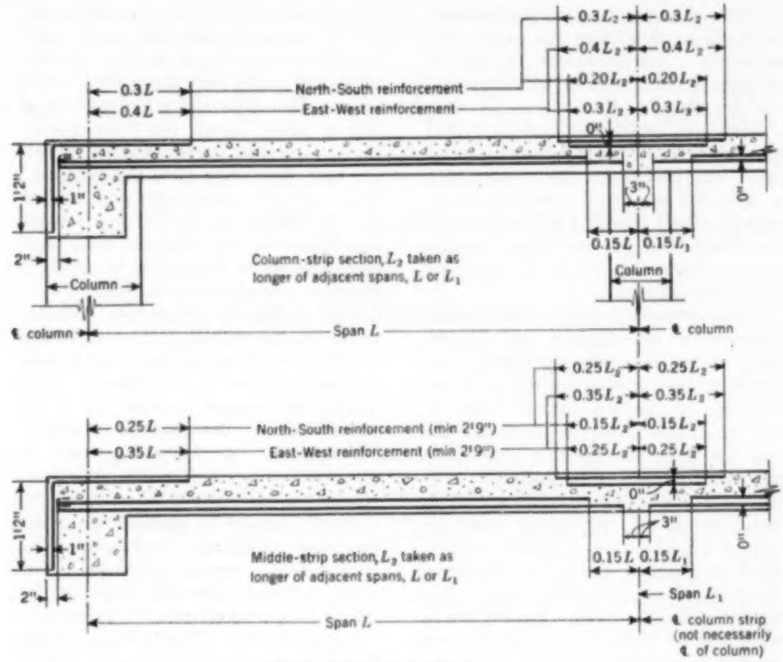
Comparative cost studies were also prepared for the use of 30-ton versus 60-ton piles in the foundation. The 60-ton piles showed a considerable saving and were specified.

The writer's firm has pioneered improvements in flat-slab design, having developed a quick and accurate system of stress analysis for discontinuous column and middle strips. (See Fig. 3.) This pattern is the rule in apartment-house design, where columns seldom line up. As these buildings will use 50,000 cu yd of controlled concrete and 5,300 tons of reinforcing bars, it was important that the most economical design be used. Furthermore numerous advantages accrue with this type of design in addition to savings in materials.

The beamless floor construction employed on this project has proved its economy on numerous other buildings in the metropolitan area. The 2,200-unit Ivy Hill project, in Newark, N.J.; the 19-story and penthouse apartment building at 2 Fifth Avenue; the River Esplanade at East 82nd Street; and the Park Briar on Queens Boulevard, are some of the projects employing this beamless type of construction.

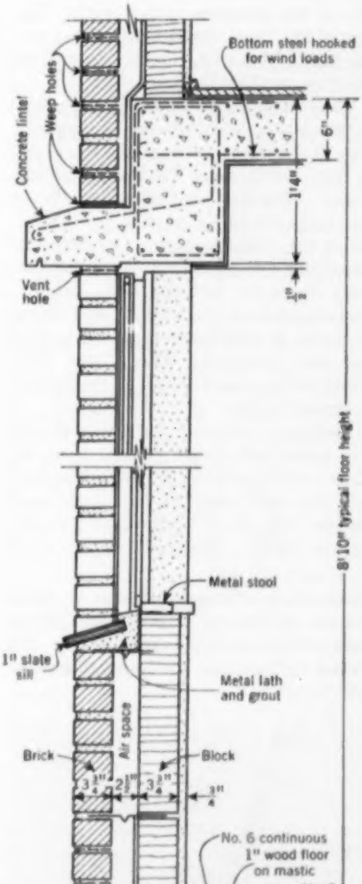
There is a clear, unobstructed, flat ceiling with no beam interruption. Therefore paint can be applied to the ceiling after proper finishing, or as used on this project, one coat of Covercoat plaster can be applied directly to the unfinished ceiling. In this instance, the use of Covercoat resulted in a saving of

FIG. 3. Typical sections through column strip and middle strip show use of straight bars for negative moment.



Typical details of flat slab

FIG. 4. Hollow wall construction, used throughout project, is supported on spandrel beam and concrete lintel at every floor. Double-hung aluminum windows are 5 ft $1^1/_8$ in. high.



3 cents per sq ft, as compared with a finished concrete ceiling.

The beamless type of design employs a simplified reinforcing pattern in which all bent bars are eliminated in the typical floor area as well as in the cores or thickened floor slabs in service areas, a great improvement over the trussed-bar system of reinforcement. Partitions are of uniform height, and since there are no beams, alterations in layout are easily made. Another important feature is that the architect can stagger the columns to suit his room layout, and the column sizes can be selected to provide a minimum of obstruction. The maximum column spacing is 18 ft.

The slab in the dwelling units is 6 in. thick, and in the core, or service area, 12 in. thick. The 6-in.-thick slab has good sound insulating properties, and the frame, as a unit, cannot be surpassed from the viewpoint of resistance to wind and blast effects.

Studies indicated that best economy could be achieved from the viewpoint of concrete, steel, and formwork if 3,000-psi concrete were used for walls, buttresses and piers, 3,500-psi for all slabs and beams, 4,000-psi concrete for columns to the fourth floor of buildings, and 3,500-psi concrete above those levels. This change in concrete mixes and studies of economy in steel reinforcement enabled the designers to restrict changes in column sizes to two levels for the height of the building. Typical columns vary from 12 × 14 in. to 14 × 16 in. at the upper levels, and from 14 × 18 in. to 16 × 30 in. at ground-floor level. Sizes and shapes were selected to suit the architect's room layouts. Column reinforcement was designed to meet the New York City Building Code requirements, varying from a minimum of $^1/_2$ percent to a maximum of 4 percent of the gross column area, but favoring the lower steel ratios.

Studies indicate a saving of approximately $68,400, or $1.03 per lin ft of buildings by the use of concrete lintels instead of steel angles. As part of the architectural treatment, the concrete lintels project 4 in. beyond the face of the brick. Exterior columns are set back $5^1/_2$ in. from the face of the brick, and 9 × 16-in. typical spandrel beams carry the exterior walls (Fig. 4).

Another feature is the cantilevered concrete balcony slab (Fig. 5). This slab is dropped 6 in. below floor level, and a continous concrete curb around the balcony provides a watertight dam and eliminates flashing. The concrete for the balcony slab and curb is a dense concrete with a hard steel-troweled finish. Experience has indicated that with proper concrete construction, there is no need for the usual membrane waterproofing, fill, and flashing. Topmost balconies have regular roofing.

Because of the height and shape of the buildings, special attention has been paid to the wind stresses. Analysis of wind pressure generally followed the procedure proposed by Albert H. Smith, A.M. ASCE, in his paper on

"Wind Bracing Problems," published in the Journal of the Western Society of Engineers, February 1933. The general procedure is described briefly in the Portland Cement Association's pamphlet, *Continuity in Concrete Building Frames*, third edition.

Computations of the elastic properties of bents for a typical floor were expedited by using, for wind analysis, the bent layout and the properties used for gravity loads. The horizontal member (slab) of the bent was considered as a beam with width margins midway between adjacent columns. The "joint" was considered as the intersection of the horizontal members with the columns, and the "joint coefficient" (v_z) was determined as a function of the stiffness (K) of the members of the joint. The sum of the "joint coefficients" (Σv_z) was the summation of v_z for all joints of all bents on one floor level.

The total wind pressure, W, was taken as the product of 20 psf and the exposed area of the structure from the top down to the 100-ft level (N.Y.C. Building Code). The unit joint coefficient ($W \div \Sigma v_z$) multiplied by v_z at each joint determines the column shear. Column moments are obtained by multiplying column shears by half the story heights. From mechanics, the sum of the column moments at each joint equals the sum of the slab moments. These were then distributed to each "slab" in proportion to their k values.

Negative moments for the slabs at the center line of the colums were reduced to moments at the face of the support and distributed to the column and middle strip in the same ratios as for gravity loads. Moments due to wind ($\pm$) were superimposed on gravity-load moments to determine the steel reinforcement. Due allowance for an increase in working stresses ($33^1/_3$ percent) was provided.

When the tabulation indicated that three-quarters of the combined stresses (with wind) exceeded the stresses due to dead and live loads (without wind), columns were investigated for stresses due to wind and gravity loads. Similar investigations were made for footings, loads, and pile caps.

The overturning moment due to wind pressure was investigated, and the stability of the structure was found to be ample without special anchorage of the columns to the foundation. The effect of lateral loads on vertical piles was less than one kip, the permissible limit set by the N.Y.C. Building Code. Actually only minor modifications in arrangement of reinforcing were required to take care of wind stresses; steel in columns had to be increased in a few cases at top-story levels. Top bars in slabs adjacent to spandrel beams were hooked and bottom reinforcing extended to provide full laps. Thus the quantity of steel added to provide for wind stresses amounted to only 1.7 percent of all reinforcing.

Superstructures now going up

The superstructure of all four buildings is now going up and the contractor expects to concrete one floor a week. The floors are being poured in three sections, averaging 8,000 sq ft each, with a volume of 210 cu yd in each section. An unusual feature is the placing of concrete for the full twenty stories by means of a crane instead of a hoist. Special heavy cranes with a 240-ft boom, made of high-strength aluminum alloy, will be used to reach upper stories. A 2-cu yd bucket is used for placing the transit-mix concrete, delivered to the job from a mixing plant across the East River. Both stone and gravel concrete mixes are used, depending upon the availability of suitable coarse aggregate at the plant. Farkas & Barron has overall supervision of the concrete work and maintains close inspection of quality, strength, and placing of concrete.

The Gulick & Henderson Laboratories do the testing. Test cylinders are broken at 7 and 28 days, and results to date indicate a consistently good quality of concrete, running 10 to 15 percent above the required strength. The placing of reinforcing steel is checked before every pour. The contractor is using plastic-coated plywood throughout for forming the superstructure. Slabs are cured by spraying with a mastic curing compound. Specially built steel forms are employed for forming the projecting concrete lintels.

Knickerbocker Construction Corp. has the contract for the concrete frames, and Monarch Concrete Co. built the foundation walls, piers, and pile caps. The 60-ton cast-in-place concrete piles were installed by Western Foundation Corp. Colonial Sand and Gravel Co. are the concrete suppliers.

The late George W. Springsteen and Herman J. Jessor are the architects for the project; William Dusenbery, mechanical engineer; Leo Novick, landscape architect; and Farkas & Barron, consulting engineers and structural engineers on foundations and on all concrete work.

Concrete in 20-story buildings is being placed entirely by crane. Here 160-ft boom is being used on crawler crane. For higher stories, boom will be lengthened to 240 ft.

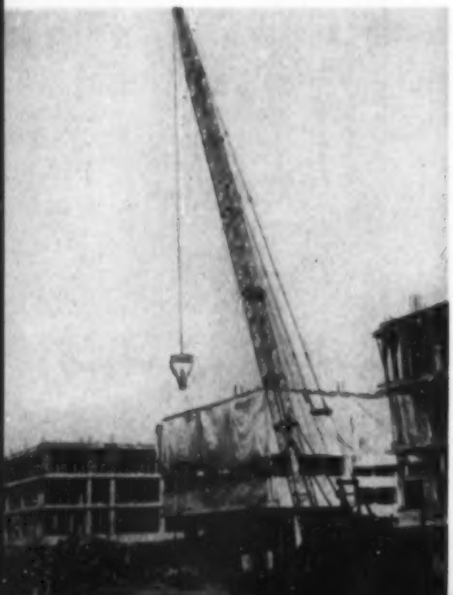
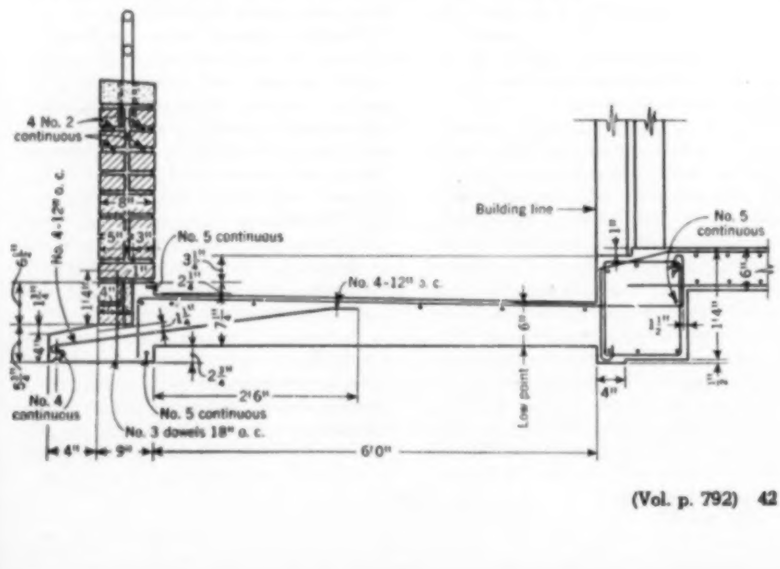


FIG. 5. Cantilevered balcony is dropped 6 in. below floor level. Continuous concrete curb provides watertight dam and eliminates flashing.



CONSTRUCTION

—the engineer's challenge

CARL B. JANSEN, M. ASCE, President, Dravo Corporation, Pittsburgh, Pa.

In giving you my slant on the challenge which construction presents to the engineer, I shall draw primarily on my own experience, which began on my graduation from college, when I received an offer of a job from a construction company in Pittsburgh. That was in 1922, when there was one job for every 20 college graduates as contrasted with today's horn of plenty with 20 jobs, more or less, for every engineer, so I accepted without hesitation.

Since the hot, smoky day when I arrived in Pittsburgh, I have never lost the thrill which surrounded that first opportunity to become actively immersed in construction. After two weeks of indoctrination in the home office, I was sent out as field engineer on a foundation construction job, and for the next 12 years I had the grandest time of my life, returning to Pittsburgh only for a few short periods between jobs.

I have been accused of remaining in a rut these 32 years by virtue of not having tried the green grass on the other side of the fence. If I have been in a rut, it has been a very pleasant one, full of new experiences at every turn, and I recommend it highly to those who have never been in it.

Largest industry in United States

We are living in an age when size assumes great importance, and for the engineer who likes to be involved in big things, he's really on top of the heap in the construction industry. This is the largest industry in the United States in dollar volume, with $35 billion of new construction in the year 1953, and an estimated $36.2 billion for the year 1954, of which two-thirds is private and one-third federal, state, and municipal. The dollar volume of construction in 1933—just 20 years ago—was one-tenth of that amount, and even after we eliminate over 50 percent of that increase because of inflation, we still have something in the neighborhood of a quadrupling of new construction volume over that 20-year period. And when we add to this new construction volume for 1954, another estimated $15 billion worth of maintenance and repair, we are mounting to astronomical figures. We had one million employees on construction in 1919—and 2.6 million building for the future in 1953. Construction is big business, make no mistake about it!

It is almost impossible to visualize in practical terms the amount of construction—new and maintenance and repair—that enters into this annual figure of over $50 billion. Probably the most impressive, as we drive through our urban areas, would be the over one million residential units estimated as being built this year. Obviously the highway we follow is also of special interest. President Eisenhower's Advisory Committee on Highway Improvements is studying means of carrying out a proposed $50-billion, 10-year highway construction program. In this year of 1954 alone, total highway expenditures are expected to reach $6.4 billion, the largest amount ever spent on highways in one year. Of this total, new highway construction will account for more than $3.7 billion. The new federal law authorizing an expenditure of $1.75 billion over the next two-year period will further accelerate this program. Toll roads, out of vogue for more than 100 years, have returned in impressive proportions. Nearly 1,700 miles of turnpike are now in the construction stage, in addition to the 751.5 miles completed and in use. In addition, more than twice that amount is in the financing stage.

In our cities we find new office buildings, parking garages, and industrial facilities under construction. In my own home town—Pittsburgh—we have seen the complete razing of an important section of the city, replacing the old, antiquated structures with modern, comfortable edifices faced with stainless steel or aluminum. New bridges and tunnels will lead traffic to and away from the Golden Triangle. A large, retarded residential district is being cleared, and in that area will rise a public auditorium, convention hall, and other civic buildings essential to the human aspects of modern living. Similar transitions are under way in any modern, progressive city in the United States.

Wherever a building goes up, a highway takes shape, a new bridge spans a river, or a dam backs the water up over hitherto dry land, the engineer is at the controls, planning and programming, directing the orderly progress of the work. He conducts the exploratory studies and develops the research, engineering, and economic reports on the feasibility of the project. He designs and plans the installation, including access to it for the construction crews and materials, the housing facilities and the means of delivering the finished product to existing arteries of transportation. He prepares the plans and specifications, carefully providing for every reasonable eventuality to insure the best possible structure for his client or employer at the lowest possible cost. He invites and takes bids for the performance of the work, lets the contract to a reputable and responsible bidder, and issues the order to proceed.

Recognizing that contractors are human and that construction men—even engineers—sometimes let their enthusiasm for production run away with them, he sets up a competent

engineering and inspection force on the job to work with the contractor in the performance of the work, with the immediate purpose of seeing that he lives up to the specifications, or deviates from them on a mutually satisfactory basis to meet emergency situations. As a contractor, I would be the first to emphasize the need for this check and balance.

On the contractor's management team

Now I come to that application of engineering talent with which I am most familiar—the place today's engineer occupies on the contractor's management team. While I use the term rather loosely, I refer primarily to the general contractor who accepts responsibility for building a complete project. This entrepreneur is one of the purest examples of free enterprise hard at work, especially in those areas of his business where by virtue of having available complete plans and specifications for the entire project at time of bidding, it is possible to award to the lowest responsible bidder on a lump-sum basis. Through the use of the combined skills—engineering, managerial capacity, common sense, good judgment, knowledge of the forces of nature, ability to get along with people, and a bit of the essential ingredient called luck—he pits his wits against his competitors with the hope of getting an interesting and difficult job and of carrying it through at a cost not in excess of his estimate. He may make a little money or he may lose his shirt—and a lot of shirts have been lost through the years in that particular business. However, that has seemed to add zest to the chase, and there is no perceptible reduction in the number of competitors for work.

But just as construction design has changed materially over the years, so the contractor has modernized and perfected his approach. No longer is his estimate of the cost of the job made on the back of an old envelope, using the unit prices bid by his competitors on the last job that he lost, and then cutting a psychological percentage off to arrive at his figure. Today his engineers keep accurate costs of every operation on the jobs he has under way. These are constantly tabulated on a daily, weekly, or monthly basis, checking against the estimated costs to evaluate how the job is going. At the end of the work these are compiled into a cost record for that job and provide the basis for bidding on similar work in the future.

The preparation of a proper estimate of cost, preliminary to bidding on a big job, is an expensive and time-consuming operation. Every facet of the problems to be faced must be explored by the contractor's engineers. Detailed plans and specifications are usually available, but the bidder must arrive at his own conclusions on how hard the rock will be, based on samples taken from the borings, and from that determine what type and how much explosive to use, how close to drill his holes, and the cubic yards of production per shift. He will never fail to observe the local conditions as to possible damage to structures in the vicinity, and will tailor the charge to fit.

If it is a marine job, he will ascertain the underwater conditions, possibly take additional soundings to supplement the information provided by the owner, and study currents and tides, the expectancy of flood and high water, and extremes of temperature which may delay the work through ice jams and sudden storms.

In these and many other situations, a college education does not provide the answers and only practical experience in performing such work on a day-to-day basis makes it possible to interpret the record intelligently and to use it in terms of dollars and cents on the next job that comes along. The chief estimator and his engineers must be able to anticipate and apply every unit of work and labor that is to enter into the job. Bid quantities for each pay item must be checked accurately. Economical methods of operation must be developed as otherwise the competing bidder who does figure on using such methods will wind up with a lower cost and will get the job.

Special studies must be made of wage scales, and with 19 building and construction trades representing the employees on a large amount of the work under way in the United States, this can become a difficult task. Decision must be reached as to whether or not a wage increase is likely to be granted in the job area during construction and, if so, about what it is going to be. Will material prices go up, or down? How can economies in methods of delivery of steel, timber, and cement be developed? What is the best equipment to use for a particular project? Is the presently owned equipment well suited to the work and, if this is doubtful, is it more economical to buy new equipment especially suited for the work, at the risk of letting the old equipment sit idle, and at the additional risk of not having a job for the new equipment after the contemplated work is completed? And don't fail to include in the estimate adequate rental for the equipment that is finally decided on!

What superintendent or project manager will be assigned to the work? This is an important question, for on him depends in a great measure the job progress and economy of operation. One man may be a pusher who makes a tight schedule and consistently beats it, but possibly at the expense of relatively high costs in materials and repair parts and a large inventory in the store room, costs which may be more than compensated by reduced overhead, plant rental, etc. The other man available may the "string-saver" type who will develop the lowest possible labor and material costs but won't get very excited about doing tommorrow what could just as well have been done today and will run the job into liquidated damages or high overhead expense, or both. So which one should be selected for the job? And how is his effect on the final figure to be evaluated?

There are hundreds of individual items going into the final price, each of which must be considered carefully and on the basis of past experience. Insurance and taxes, social security and retirement plan, power and water, fuel and telephone must be included. The cost of bidding on those last several jobs, which the contractor didn't get, must be distributed on an overall long-term basis so that his work on them will be paid for by the jobs he does get. No one else is going to pay for this work, and certainly not his competitors!

And then at the end is usually added the wee small figure called profit. This is the item, after the job is completed within estimated costs as the result of effective performance, that is set aside for expansion and improvement of the contractor's business. Probably he spends every dollar of it for the new shovel, a line of modern trucks, or a new engineering office, or air-conditioning of the old one, so he can do a better job and stay in business in the future.

The job is landed!

All right! So you landed that one wet job you were after, out in the wilds, miles from the nearest railroad and with access highways restricted as to maximum load. But you are glad, very glad, to get it, for it's the first job you've gotten this year in spite of bidding madly on everything in sight. It's going to be a tough job. You bid it close to get it, so you put your best man in charge. It was awarded in the early summer. It's in cold country with a short working season and you know you've got to get as much done as possible before the winter freeze-up. If you get your plant in shape in time, you'll be able

to work all winter. If you don't, you're sunk!

Everything and everybody starts to roll. The site is cleared. The workmen are good. You happen to operate customarily on a union basis, and you are able to negotiate a sensible agreement with the unions representing the trades required, under conditions that should produce harmonious working relations. Work can proceed three shifts daily around the clock, six days per week, and emergency work on Sundays. You move in trailers for housing the workmen, and set up temporary field offices until you can get enough clearing done to erect permanent buildings.

The new trucks and shovels start to arrive, some in pieces because of highway restrictions, and have to be assembled at the job. Some come in by water, on barges, and you hope they don't sink on the way in a sudden, unexpected storm. But you have a few breaks and there is no storm. The war is over, so steel piling comes in on time after a lot of pushing and hauling from the home office and all along the line, commonly called expediting.

The superintendent is rapidly assembling his working force, sparked by key men from your permanent organization. His assistant superintendent and night superintendents, field engineers, general foremen and operators of key equipment provide the small nucleus around which is built an army of workmen. This crew includes some "floaters" who follow construction as a permanent business, but mainly local skilled construction men who wait for the work to come to them, and unskilled laborers who do not require previous training. But they are new to the contractor's organization and have to be indoctrinated immediately into the basic policies and procedures that will make it possible to operate as a smooth-running construction force. Safety regulations, employment policies, working rules and conditions—all will be explained to them with a minimum of lost time.

The job management consists almost without exception of technically trained men. Half a century ago the superintendent of a large construction job had as one of his major qualifications the ability to lick every man under his direction, and a pick-handle was the favorite tool for that purpose. Not so today! Now the boss-man on a construction project—call him superintendent, project manager, or whatever you wish—is in a position of peculiar importance. Although he usually operates in accordance with a prearranged plan provided by the home office, nevertheless he is "king" on the job as far as the contractor's organization is concerned. He may be furnished with key men from the contractor's overall organization but his is the final authority with respect to their activities on the job.

Every construction job is a new and complete organizational problem, starting from scratch. It provides every situation in the book and many never in print, and the young engineer working up through a contractor's organization learns through practical experience. Planning and scheduling, purchasing and expediting, daily production problems, manpower—all must be handled promptly and accurately.

But the realm of human relations, here as elsewhere, is paramount today. In addition to keeping the boss and the staff at headquarters in a cooperative frame of mind, the construction superintendent must develop a spirit of competition and pride of accomplishment in his new "team," assembled at the start of each job, if he is to obtain maximum production. He must delegate authority, and at the same time insure output of proper quality and quantity. If he is operating a union job, he is probably the one who must handle the major grievances and clear them up with one hand while keeping the job going with the other. Very often he can head these off if, in addition to his textbook "larnin'", he was born with, or has accumulated, that intangible but extremely important quality of being able to get along with people. And while he is busy extracting every ounce of planning, engineering, and administrative skill from his staff, he must accord them, individually and collectively, maximum opportunity to carry increasing responsibilities, and in this and all other ways help them prepare for the day when they will have his job.

Top training for management

I know of no practical experience that is more effectively designed for the development of men for management than that which becomes available to the young engineer on construction. I was fortunate in that my first assignment was on a relatively small foundation job. Little engineering was required and I was able to spend considerable time with the construction crews—with the carpenters and pile drivers in particular, and with the "sand hogs" during their long rest periods between shifts under air in the caissons. It was a wonderful opportunity to learn from the "old timers" who had spent their lives on this work, though without the advantage of much formal education.

I discovered that it was not drudgery but rather a pleasure to move through all the operations, including rod work, carpentry, firing the boilers and running the air compressor, now and then taking a turn at the throttle of a crane, and even learning a few secrets about how to handle a sledge hammer. The spell as "top man" on pile setting carried a certain thrill not to be forgotten, expecially on a windy day, and the first venture into the mysteries of high explosives was indelibly impressed on my memory—particularly since safety was something which happened more or less by accident on a construction job in those early days, as contrasted with the constant priority emphasis that subject now receives. Later on, having the feel of the work, it was a normal transition over a period of years to shift foreman under compressed air, to general concrete foreman, and then to superintendent.

And so, through those early active years I found an opportunity that is, in my opinion, absolutely unparalleled in any other line of industrial enterprise. I can readily appreciate that for those who might dislike construction as a business, it could be a rather horrible experience. For the engineer who wishes an easy or routine job, I would not recommend it. If you like your dinner promptly at 6:00 p.m. don't go into the construction business—except at the strictly local level. You may get your dinner but it won't always be at home and not always that same day! If new faces and places have no interest for you, pass it by!

But if you wish to follow your engineering career in a field where every day leaves you certain of accomplishment, possibly physically depleted but mentally alive, construction will have much to offer. If you enjoy seeing the results of your work grow beneath your hands, and if you glow with pride over the completion of a structure—any structure—in which you have had an important part, construction will give you a lift that you cannot get elsewhere. If you like to work with people and if you desire to lead others in their daily chores, construction is the place for you. If you wish to improve yourself in the broad fields of management, and at the same time extend your horizon, there is no better teacher, no wider stage, than construction, the engineer's challenge!

(This article is based on Mr. Jansen's address at the ASCE Annual Meeting in New York, before the Employers-Employees Luncheon sponsored by the ASCE Committee on Junior Members and the Metropolitan Section's Junior Branch.)

Nine-story prestressed-concrete building erected in Germany

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Up to a few years ago, prestressed concrete was used solely for statically determinate structures. It was difficult enough to make simply supported beams by this new technique, without undertaking the additional problem of continuous beams and frames.

This position could not be maintained long as it is obviously impossible to build multistory buildings by using only simply supported beams. On the other hand, bridge construction problems can often be solved only by making two or more spans continuous.

The very first application of prestressed concrete to continuous frames was made in a building in Belgium by the contracting firm of Blaton-Aubert. This building, erected in the contractor's yard, is shown in an accompanying photograph. It has two stories and a 66-ft span. The columns are of reinforced concrete and at each floor level they are provided with a protruding concrete block serving as end block for the beams.

The beams are in prefabricated elements, H-shaped in cross section and about 10 ft long. The prestressing cables were placed one on each side of the web and threaded through housings in the end blocks. In this way, the columns were pressed against the beams, thus providing the necessary stiffness at the junctions of beams and columns. The total depth of the beams was only 2 ft 4 in., which is very little for a 66-ft span.

This was a very unimportant application but it provided useful experience and enabled tests to be made to check whether the hoped-for continuity really existed. These tests showed that the measured deflections of the beams agreed within 4 percent with the computed ones obtained by applying the elastic theory to the frame.

After this experiment, many buildings were erected in Belgium and other European countries utilizing the same principle. The present article describes the most important application to date—a huge laboratory building built in Munich by the contracting firm of Siemens Bauunion for the German firm of Siemens & Alske. This building has nine floors and a span of about 52 ft. The frames are about 11 ft 6 in. apart. The columns have the same cross section throughout their whole height (about 19 × 27 in.); the beams have a rectangular cross section of about 15 × 25 in., including the slab thickness; and the floor slabs have a thickness of about $4^3/_4$ in. See Fig. 1.

The beams are prestressed by the Blaton-Magnel system with a total force of 160 tons (two cables of 40 wires of 0.207-in. diameter). The cables were placed in the formwork inside corrugated flexible steel sheaths.

To avoid having the anchorages seen from the outside, the cables were not carried all the way through the 27-in. depth of the columns. The anchorages were placed about 8 in. in from the exterior face of the columns, and this space on each column had to be concreted after the prestressing operation was finished.

With this arrangement, the outside vertical column reinforcement in front of the anchorages could not be placed until the prestressing was completed. The reinforcing bars were interrupted at each floor level at a point somewhat lower than the anchorage. After prestressing, the connecting bars were

First application of prestressed concrete to continuous frames in Belgium was made in structure built by contracting firm of Blaton-Aubert in its own yard. Two-story building of 66-ft span was subjected to tests which showed high degree of continuity in frame.

Laboratory building of Siemens & Halske in Munich, Germany, is of prestressed concrete frame design. Building has one wing of 9 stories and another of 6 stories, also of prestressed concrete frame design.

placed and screwed with a turnbuckle onto the ends of the bars above and below.

The maximum stresses in the structure are as follows:

At midspan:

Under dead load	1,300 psi
Under full load	800 psi

Near the columns:

Under dead load	1,300 psi
Under full load	1,460 psi

The building covers a total area of about 25,000 sq ft. It contains about 10,300 cu yd of concrete, 528 metric tons of mild steel, and 40 tons of high-tensile-strength wire.

The outside faces of the columns were built in hard-wood forms so as to obtain a perfectly smooth appearance. These forms were thoroughly readjusted and surfaced after each use. The result was that the openings left in the main fronts for the window frames were accurate to within about 0.08 in. This permitted a very rapid placing of the window frames and also a rapid closing up of each story a few days after the corresponding part of the skeleton was finished.

As for the construction sequence, the columns corresponding to one floor were concreted first up to the level of the soffit of the beam. Then all the reinforcing bars and the cables (in their housing) were placed. Next the concrete for beams and slabs was placed.

The grading of the aggregates was chosen very carefully, and a no-slump concrete was used. For the well-vibrated concrete, this gave crushing resistances, on 8-in. cubes, of 6,000 psi at 3 days, and 9,500 psi at 28 days.

The great advantage of combining continuity and prestressing lies in the fact that the construction depth of the beams can be reduced to a minimum—about one twenty-fifth of the span—although the working load on the floor is as high as 120 psf. This high ratio would be impossible in reinforced concrete and an exceptional achievement in structural steel.

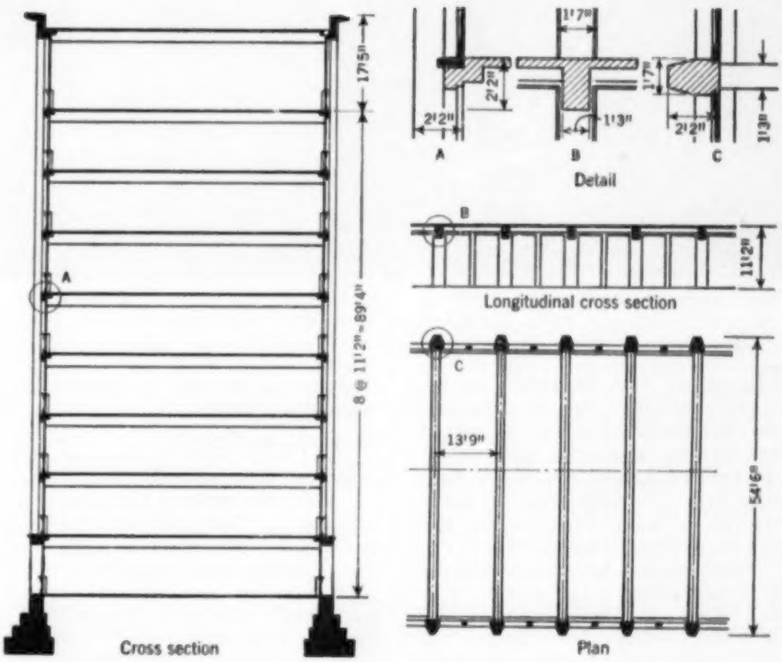


FIG. 1. Application of prestressed concrete to multi-story laboratory building in Munich, Germany, is shown in cross sections. Black areas indicate prestressed reinforced concrete beams with end blocks so designed as to press beams against columns and thus provide necessary stiffness. Building is about 107 ft high and average story height is 11 ft. Working floor load is 120 psf.

Interior view of Munich building shows prestressed concrete beams in place before rooms were finished off. Long beam span gives maximum flexibility in interior layout, and shallow beam depth permits minimum story height.

Helicopter

Skilled helicopter pilots are necessary on all mapping projects. When "density altitude" conditions are favorable, little more than elbow room is needed for a high-station landing.

During the past six years, the use of the helicopter has revolutionized the topographic mapping of rugged and remote areas. It has enabled the field topographic engineer to keep pace with the rapid advances made through the use of aerial photography and stereoplotting instruments.

Transportation has always been an important factor in the rate of progress made in providing maps for civil and military use. Horses and mules were often a luxury to the early surveyors in the West, and when available, were a great improvement over the slow and laborious method of making traverses on foot. Motor vehicles added speed and a greater degree of comfort where roads or open country were to be mapped. The outboard motor replaced the canoe and the rowboat for stream traverses or water transportation. In the late twenties small airplanes were successfully used under more or less emergency conditions to transport survey parties in the more remote areas of the northern United States and in Alaska. It was not until 1948, however, that the long-cherished dream of the leg-weary mapmaker became a reality. During the early spring and summer of that year helicopters were used successfully by the U.S. Geological Survey to transport observers and surveying instruments to mountain stations. A new era in topographic mapping had begun.

Pioneering by U.S.G.S.

In the spring of 1948, to test the use of the helicopter in surveying and mapping, the Geological Survey set up an experimental project in Colorado. The successful bidder provided a two-place helicopter powered with a 178-hp engine. This ship was thought to have a hovering ceiling of about 8,000 or 9,000 ft. The Colorado experiment lasted 30 days and proved to the observers that a satisfactory substitute had at last been found for the pack trains of the Old West. Before long topographic engineers were talking in terms of "density altitude," "hovering ceiling," "ground effect," and "jump take-offs," and helicopter pilots were becoming interested in "strength of figure," "triangle closures," and "simultaneous reciprocal vertical angles."

As a result of the Colorado test, specifications were prepared calling for the use of three helicopters in Alaska during the summer of 1948, one of which was to be used in southeastern Alaska and two in the interior near Big Delta.

That summer's work in Alaska established a pattern for helicopter use in surveying that has been followed with only minor modifications since that time. Mapping with helicopters has been carried on over most of southeastern Alaska, about 100,000 sq miles in central Alaska, and over extensive areas in the western United States.

Until about 1930, the topographic mapping of a single quadrangle was essentially an operation for one field survey party. The topographer in charge established horizontal and vertical control and later sketched the map detail by use of the planetable, telescopic alidade, and in some instances, the aneroid barometer. On completion of the field sketching, the topographer usually returned to headquarters and assisted in preparing the map for final publication.

Field sketching demanded an intimate study of the terrain, so that the topographer could note and commit to paper the many and unusual features that occur in nature, or are imposed on nature by man. This intimate study took time, and that time was provided in part by the relatively slow progress which a man could make on foot, by pack train, or by motor vehicle.

The advent of the aerial camera, with its remarkable facility for committing detail to film for later study, reduced the importance of an intense terrain examination by the topographer. Instead, his principal tasks became the interpretation of cultural features

revolutionizes topographic mapping of remote areas

GERALD FITZGERALD, Chief Topographic Engineer, U. S. Geological Survey, Washington, D.C.

and the geodetic fixing of ground points, which could be used to orient the photos in later mapping operations. Quick transportation from point to point thus became a considerable factor in the map completion cycle. For these reasons, following the first transcontinental flight of a helicopter in 1941, engineers of the Geological Survey watched with interest and expectation the development of this unique means of transportation.

Preliminary planning of all topographic mapping projects, which includes the selection of areas to be mapped, budgeting and scheduling, follows the same pattern regardless of the nature of the transportation afforded the field personnel. After preliminary planning, contracts are let for the procurement of aerial photography, and field work is undertaken to provide the horizontal and vertical control needed for the stereoplotting of the map detail.

In the western United States and Alaska, particularly where the terrain is rough and roads are scarce, field operations for accuracy testing and field completion are combined with control surveys in the interest of economy. The use of the helicopter in such field operations during the past six years has had a revolutionary effect.

The pattern established for helicopter use involves careful planning and close coordination of field operations in order to secure maximum economy in flying time. Using the aerial photographs, horizontal and vertical control points are tentatively selected. Proper selection of these points is especially important in Alaska, where the terrain varies from low, swampy tundra to glacier-mantled mountain ranges topped by Mount McKinley's 20,300-ft elevation. In general, horizontal positions (geodetic coordinates of photo-identified ground points) and vertical-angle elevations are established about 16 to 18 miles apart throughout the area to be mapped. In addition to these points, other elevations for contouring are established between the foregoing points by vertical angles or barometric leveling. In Alaska there are few level lines, and these are established principally along the Alaska Railroad and the more important interior highways. It is necessary, therefore, to maintain a high degree of accuracy in vertical-angle observations.

Barometric leveling by the two-base altimeter method to obtain elevations for supplemental vertical control is used extensively in Alaska. The practicality of this procedure has been increased through the rapid coverage afforded by the helicopter. Early in the planning, a decision must be made as to the extent of the area that can be controlled from two bases. On the assumption that weather conditions would prevail which would reasonably assure that most of the points would be correct within 10 ft, or one-tenth of the 100-ft contour interval generally used, a rectangular area is selected with a high and low base on opposite sides of the area and not over 20 miles apart. After sites for bases have been selected, a tentative flight plan is made which includes as many as possible of the supplemental vertical control points within the rectangular area. The party chief who carries out altimeter operations makes a final selection of the points to be controlled, selecting points on which or near which the helicopter can land.

To increase efficiency, the altimeter work usually is done at the same time as the triangulation. The highest triangulation station in the area is often selected as the high base, and the triangulator acts as base tender during the altimeter run. If possible the low base is located at a level-line bench mark on a highway. The engineer carefully plans his route so as to visit all points in the shortest possible flying time. The helicopter is normally flown at about 60 miles per hour and has fuel capacity for about three hours of normal flight on these runs. Careful attention to the work routine as well as to the flight planning of these trips is therefore very important. Altimeter readings must be made with care, and the identification of the selected point on the photograph must be correct, to avoid the necessity of a second visit.

Altimeter control for elevations with the helicopter is greatly facilitated by direct radio phone communication between the observer with the helicopter, the high- and low-altimeter base tenders, and the main camp or operations base. Various methods of trigonometric leveling are used to check critical altimeter elevations.

A typical operations headquarters consists of a base camp serviced by one helicopter, its pilot, and mechanic.

Engineer is ready to leave base camp in Talkeetna Mountains, Alaska, for "high-base" altimeter and triangulation observations. He takes nylon tent, bed-roll, gun, and C-rations for use in emergency.

There are generally four engineers, one cook, and two field assistants. The party chief acts as the director of operations. A 25-watt two-way radio is maintained in the base camp. The helicopter provides transportation for the engineers. They, and the helicopter pilot, each have 2-watt walkie-talkies so that hourly coordination of operations can be maintained and valuable time conserved.

If possible, the base camp is located where it can be serviced by truck, boat, or fixed-wing aircraft. Also, it is located so that the helicopter operates within a radius of 100 miles from it. Base camps are located about 150 miles apart and within radio communication, so that more than one helicopter can be made available in an emergency. Whenever possible, weather forecasts are received twice daily. They are very helpful in planning daily field operations. Considerable flight time and survey man-hours are saved by planning the work each day on the basis of these weather forecasts. The two-way radio not only permits close coordination and team work among the field parties but is an important safety factor in case of accident or other emergency.

For triangulation operations, after the reconnaissance has been completed and initial station signals erected, three observers are flown to their stations. When available, the helicopter is used to transport a field assistant and target material to new stations for signal building as required. It is customary for an engineer on leaving camp for an extended observing trip to take with him a small nylon tent, a light bed-roll, a gun, and sufficient C-rations so that if the weather closes in or the helicopter becomes disabled, he can remain on station for several days. If the weather remains good, it usually requires about two hours to measure the angles and to identify the required number of reference ties on the aerial photograph. Through radio communication, the party chief at camp checks the progress of the observer and directs him to a new station when his work is completed.

Snow is no deterrent to helicopter on floats. Note "spike camp" tent at mountain station near Alaska-Canada boundary in southeastern Alaska.

Helicopter in Death Valley mapping

Spurred on by the encouraging results of the Alaska field work with helicopters in 1949, the Pacific Region of the Geological Survey's Topographic Division contracted for use of two two-place 178-hp helicopters during the fall of 1949. The mapping project on which the helicopters were used consisted of sixteen 15-min quadrangles in California's Death Valley. The rugged terrain of this desert country ranges in elevation from minus 280 ft (the lowest point in the United States) to 11,049 ft on Telescope Peak. Roads are few and far between in most of the area. Although the elevations of many of the high points exceeded the hovering ceiling of the helicopters, field work was greatly speeded up by providing rapid transportation of personnel at least part way up to the higher mountain stations.

During the summer of 1950 a party working on triangulation and supplemental control for mapping in the vicinity of Mount Baker, northwest Washington, was equipped with two helicopters. Although the country was rugged and high, with snow on the mountain tops and heavy timber on the lower slopes and in the valleys, field work was completed in record time. A similar mapping project utilizing helicopters was undertaken near Las Vegas, Nev.

In the fall of 1951, the Geological Survey began a high-priority mapping program in the Colorado Plateau areas of eastern Utah and northern Arizona for the Atomic Energy Commission. Plans called for speedy delivery of advance maps at 1:24,000 scale with 20- and 40-ft contour intervals over an area totaling about 17,000 sq miles. Most of the terrain lies between 6,000 and 10,000 ft above sea level, with some mountains exceeding 12,000 ft. The presence of many deep-cut canyons and the scarcity of roads render it as rough and isolated as any area in the continental United States. The inaccessibility of much of the area to conventional means of travel, together with the fast mapping schedule required by the Atomic Energy Commission, made it necessary to use helicopters to expedite the work.

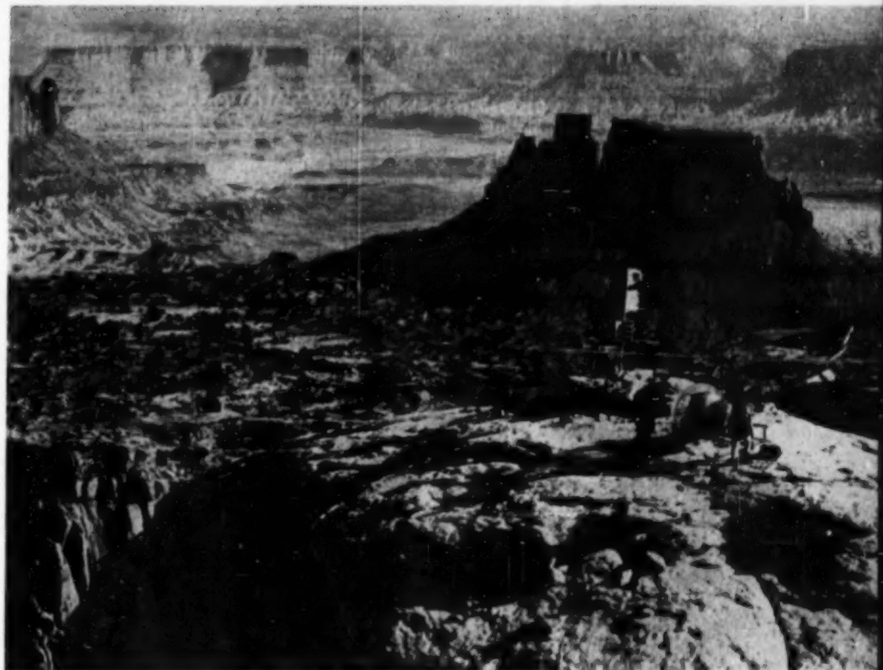
Accordingly, three helicopters were placed under contract to furnish transportation for the ten engineers and their field assistants who were employed on the project. All field phases of the topographic mapping were carried on concurrently. These included basic horizontal and vertical control, photo control (supplemental vertical) photo-interpretation, cross sections for later accuracy testing, and the preliminary computation of all triangulation and leveling data. Throughout the area there was comparatively little existing basic control; therefore it was necessary to build a strong triangulation net to obtain elevations by vertical angles as well as horizontal control. Distances through the basic nets were held to a minimum of 8 to 10 miles to assure acceptable results for vertical control. Although vertical tie points such as level benchmarks were approximately 100 miles apart by air line, on the outer edges of the area, satisfactory closures were obtained.

Considering that in approximately 45 percent of the eleven western states of the United States the elevation is above 5,000 ft, and in 20 percent it is above 7,000 ft, it is advisable to confine helicopter operations to winter months in order to exact the greatest advantage from the favorable density altitudes which can be expected over about half this area during that season.

Six years of experience in using the

Right:
Castle Butte, Utah, would be difficult to use for triangulation station without helicopter. About 17,000 sq miles in Colorado Plateau area of Utah and Arizona were controlled for mapping by helicopter, for Atomic Energy Commission in fall of 1951.

Below:
Home base can be reached in 10 minutes by helicopter—or many hours on foot. In mapping remote areas in western United States and Alaska, altimeter work usually was done at same time as triangulation.



helicopter on surveying and mapping operations in the western United States and Alaska have clearly demonstrated that this method yields substantial savings in field costs and greatly increases the speed of mapping extremely difficult terrain.

A few relative costs

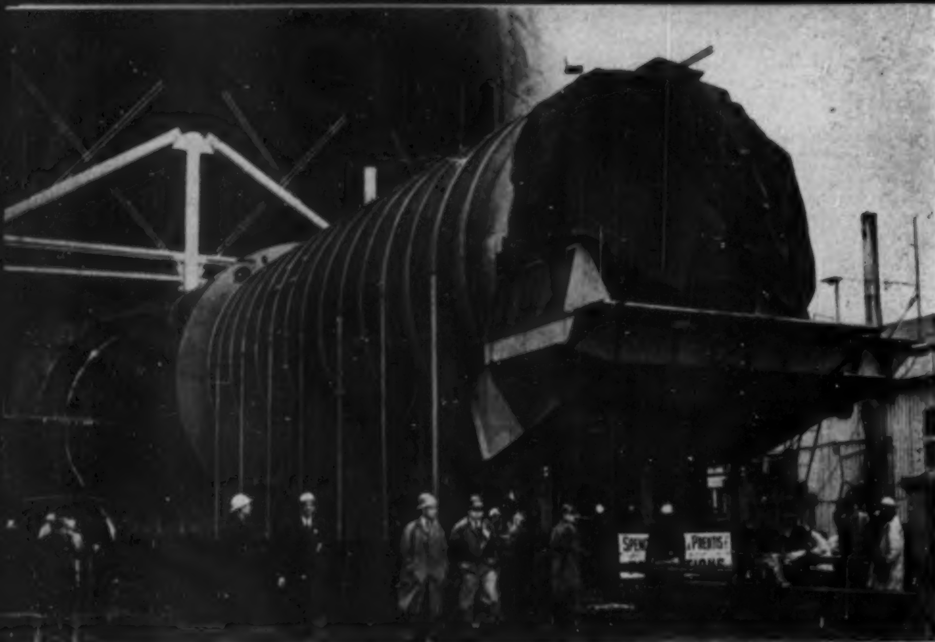
Helicopters are hired under contract to carefully prepared specifications. A daily rate is specified for standby time and the contractors are invited to bid on a price per hour for flight time. Flight time has ranged in cost under contract from \$46 to \$180 per hour, depending on the location of the project and other factors.

Field costs for mile-to-the-inch mapping in Alaska were about \$25 per sq mile before the helicopters were used. Since their use, the average cost has been less than \$8 per sq mile. Direct money saving in the western United States has been less spectacular, but in areas where comparisons are practicable, omitting small projects of less than 1,000 sq miles, the use of the helicopter has cut costs. In this regard it should be emphasized that most of the areas mapped with the aid of the helicopter have been remote and virtually inaccessible to ordinary ground transportation. For this reason on some projects the cost of the work without the helicopter would unquestionably have been prohibitive.

On all mapping projects where the helicopter has been used, the greatest saving has been in manpower. Experienced and well-trained personnel have been used with maximum efficiency. This has been possible because a large number of parties can operate from a common base under competent supervision. All field operations can be coordinated, and periods of good weather can be used most effectively.

At present, transportation by helicopter is not feasible in many of the higher mountain areas because of limited power and limited cruising range. These limitations, however, appear to be temporary. Considering the advances in helicopter design now under way or contemplated, it is certain that this means of transportation is destined to play an increasingly important role in field surveying and mapping operations throughout the world.

All photos in this article, and that on the cover, are used by courtesy of the U.S. Geological Survey.



MOVING

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M. ASCE

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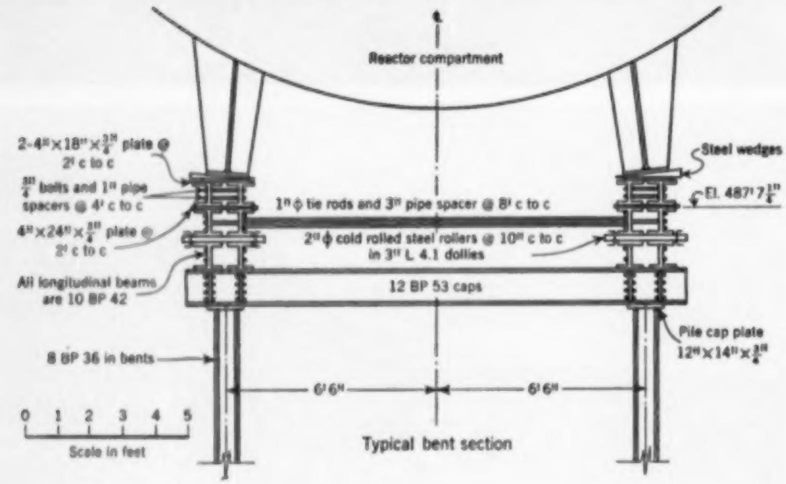
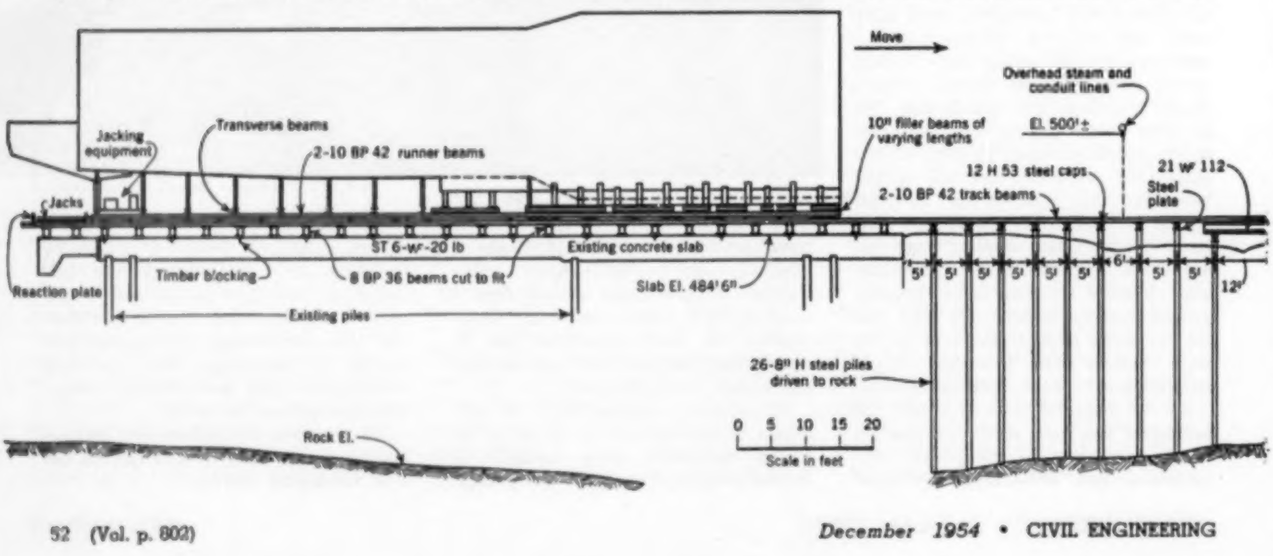
Prototype hull and associated equipment for an atomic submarine developed for AEC is moved from slab on which it was constructed into steel test sphere. Total moving distance was 222 ft, of which about 85 ft was distance between slabs.



According to recent reports, the prototype power plant for the Navy's new atomic-powered submarine, the USS *Sea Wolf*, is progressing satisfactorily inside its huge steel test sphere at West Milton, N.Y. (See CIVIL ENGINEERING for February 1954, p. 74.) For the sake of speed and ease of construction, the prototype hull with associated equipment was not completely assembled inside the spherical steel housing as many believe. It was constructed simultaneously with the housing but at a distance of some 222 ft from it. The atomic reactor is to be installed in the hull after it is in place within the steel sphere.

FIG. 1. Two double tracks of 12-in. 53-lb H-beams, placed over pile-supported bents, carry rollers for moving 1,300-ton engine. Motive force was supplied by four hydraulic jacks designed by Spencer, White & Prentis, low-bidder on subcontract for moving job.



1,300-TON ATOMIC POWER PLANT

Half-inch horizontal tolerance maintained

One of the more interesting phases of the overall project was the moving of the 1,300-ton prototype hull, with partially installed equipment, from its erection slab, across somewhat unstable ground, and into the test sphere. The accompanying photographs are the first to be released showing this operation.

The entire 222-ft trip took only $6^1/_2$ hours, but moving day was preceded by five weeks of elaborate preparation. Perhaps the most critical restriction was that the huge unit had to be kept almost perfectly horizontal throughout the operation because of the delicate machinery it contained. Specifications limited the deflection tolerance between the front and back ends of the unit to a maximum of plus or minus $^1/_2$ in., and to within plus or minus $^1/_8$ in. on the machinery end. To assure that these tolerances would be met, a careful schedule was worked out for the crews of Spencer, White & Prentis.

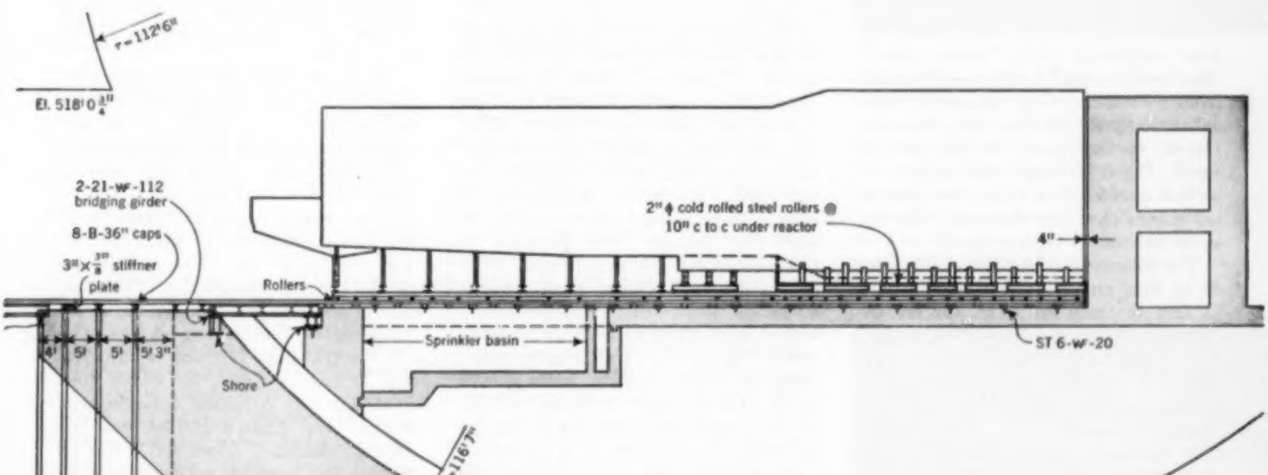
When investigation showed that the area between the power plant and its sphere was filled-in land which could not carry the weight without too much compression to maintain the deflection tolerances, a steel trestle was built to span the 85-ft distance between the construction slab and the lip of the sphere. (See Fig. 1.) Thirteen pairs of 8-in. bearing piles were driven to rock at an average depth of 36 ft, on an average of 5-ft centers. The only exception to this spacing was a 12-ft jump over existing water lines, a storm sewer, and an electrical conduit. This 12-ft gap was spanned with longitudinal 21 WF 112 girders.

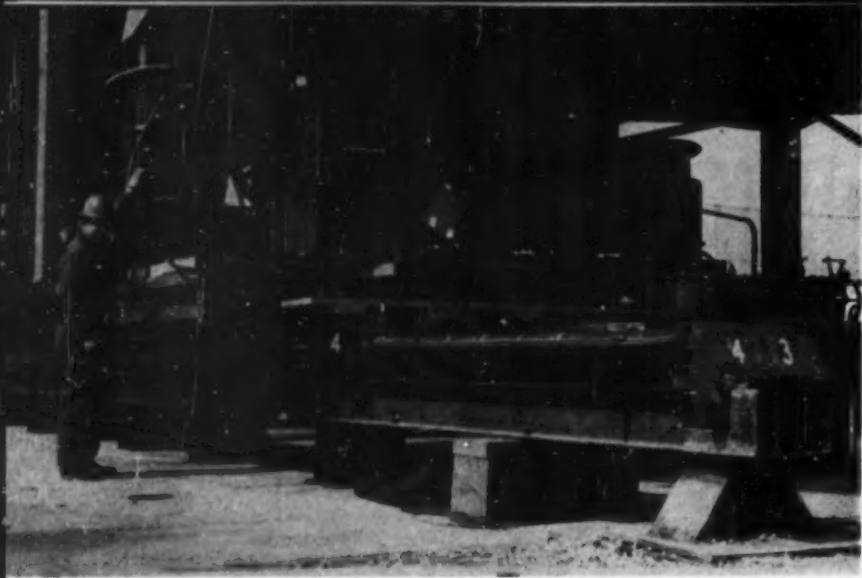
The piles formed two parallel lines 13 ft apart, and were capped with 12H53 beams to form bents. The bent tops were set slightly below grade so that the rails placed on top of them could later be shimmed with steel wedges for last-minute leveling. By using all steel and no compressible timber, minimum deformation was guaranteed.

The trickiest part of the preparatory work was transferring the weight from the typical shipyard timber chocks and blocking which supported the hull during its construction, to the steel tracks and runner beams used in the moving operation. The weight of the structure, which had been spread throughout the concrete slab by means of the timber blocking, had now to be transferred to two double rails.

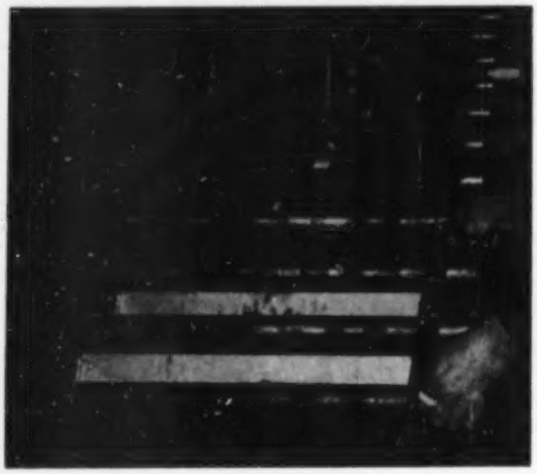
The contractor feared that the knocking out of any single set of chocks might cause minute deflections. To prevent this, before a set of chocks was knocked out, the sets of chocks on each side were jacked up $^1/_{16}$ in. (which called for a 50-ton thrust by each of the four jacks). When this slight upward camber had been introduced into the hull, the intermediate blocking was removed and a transverse 12-in., 53-lb beam was tack-welded in place under the hull. Two steel columns were then placed and wedged up between the slab and the under side of the transverse beam. This operation was repeated until all the wood chocking had been replaced. As successive sets of jacks were slacked off, the preset camber disappeared and the hull became perfectly level.

The two rows of supporting posts were just inside the line of the tracks, so that they did not interfere with subsequent work. Since the prototype hull was constructed at the level it would occupy in its final position inside the sphere, the entire trestle was constructed to maintain this level throughout the moving operation. Since the steel trestle was made higher than the concrete work slab, the bottom track beams under the load were also supported on a line of short vertical steel stubs resting on the slab.





Four jacks (of which Nos. 3 and 4 are shown) supply motive power for moving 1,300-ton prototype submarine hull with installed associated equipment. At right end is bearing plate against which jacks push. At end of jacks' 5-ft thrust, plunger is automatically retracted, drawing bearing plate up simultaneously in preparation for next thrust. Plate is self-locking as soon as it receives thrust.



Rollers, of cold rolled steel, are 28 in. long and 2 in. in diameter, held in channel carriages in sets of three to maintain their position at right angles to direction of travel. Note double track, consisting of H-beams, on which rollers run, and second double set of H-beams placed above the rollers.

Two double tracks were made up from additional 12H53 beams, placed directly above the bent legs and running from the far end of the slab within the sphere, over the filled-in land, and continuing to the far end of the slab on which the 1,300-ton unit rested. A second double set of beams was placed on rollers over the first set, directly under the unit to be moved.

The rollers, of cold rolled steel, were 28 in. long and 2 in. in diameter, held in sets of three on 10-in. centers by channel carriages, which in turn were held in position at right angles to the direction of travel, by welded angles parallel to, and midway between, the successive rollers. Thus, when a workman inserted a three-roller frame and shoved the channel up flush against the track beams, the rollers were automatically lined up at right angles to the direction of travel, thus assuring a straight move.

The actual motive force was provided by four hydraulic jacks, specially designed by Spencer, White & Prentis. These jacks, veterans of many previous moving jobs, have a 5-ft thrust. During the thrust, heavy pipe-inclosed springs attached to the footplate are stretched. When the pressure is released, these springs automatically retract the plunger and footplate in preparation for the next thrust. The foot plate, or bearing plate against which the jacks push, is automatically locked in position as soon as thrust is exerted against it. Unlike most jacks, these can be actuated by water as well as oil. The hydraulic pumping machinery to power them was set up on the aft end of the structure to be moved.

Throughout the entire move, the level of several points on the huge unit was checked continuously. The maximum actual deflection noted was $^{3}/_{16}$ of an inch, which occurred when the unit moved off the concrete slab on which it had been constructed and onto the temporary steel trestle. This deflection was corrected to zero when the unit mounted the concrete slab within the sphere, the goal of the moving operation.

When the prototype hull had been successfully moved into final position inside the sphere, the weight of the reactor end was transferred from the track beams and rollers onto four permanent concrete cradles, the bottoms of which measured 7 $\times$ 10 ft and the tops of which conformed to the circular contour of the hull. On the machinery end, the existing vertical ribs were merely extended down 4 ft to the foundation slab.

Just how much force is needed to move a heavy structure with such a jack-and-roller arrangement? We have found over the years that a reliable rule of-thumb is to plan for about 2 percent of the total load. Thus, for the 1,300-ton atomic submarine prototype, 26 tons of force were required. Since four jacks were used, an equalized force of $6^{1}/_{2}$ tons was exerted by each, which in turn called for gage readings of 1,000 to 1,100 psi.

The Knolls Atomic Power Laboratory, operated by the General Electric Co. for the AEC, is in charge of the submarine power-plant test installation in connection with which this moving operation was carried out. H. N. Hackett was manager, and James Warden was coordinator, of the Construction Section at the West Milton site for the General Electric Co. Construction of the hull and installation of the associated equipment were performed by the Electric Boat Division of the General Dynamics Corp., for which John Stoddard was Assistant Site Superintendent and Russell Haidet was Site Superintendent. Spencer, White & Prentis Inc., was the subcontractor for the moving operation here described, with the writer as superintendent of operations. The contract price for the move was $79,000.

More research on aerated flow needed

First article in a series sponsored by Committee on Research of ASCE Hydraulics Division

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Aerated flow, a matter of vital interest to hydraulic engineers, has been the subject of considerable research. To bring to light those phases of this challenging subject most in need of further study, the Research Committee of ASCE's Hydraulics Division arranged an open meeting to discuss "Research Needs in Aerated Flow," at the joint meeting of the International Association for Hydraulic Research and the Division, held in Minneapolis, Minn., in September 1953.

Of the 70 people attending, one-third contributed to the discussion, including engineers from France, Yugoslavia, and Canada. Discussions were concerned with the mechanics of air entrainment and the effect of aeration on the operation of open and closed conduit structures. Discussions on velocity measurement indicated a need for proper calibration or standardization of methods. A definite need for continued research in the field of aerated flow was evidenced.

In regard to the mechanics of air insufflation, the chief problems considered were the scaling parameters involved in this process, the mechanics by which air is mixed with water, and air entrainment caused by vortex motion. It was the consensus of opinion that turbulence is extremely significant in keeping the air in the flow and in many cases in entraining it—a point in need of research. In certain problems the Froude number is an indication of the rate at which air enters the water, as by the hydraulic jump, but the Reynolds number should also be considered, as turbulence must keep air in solution.

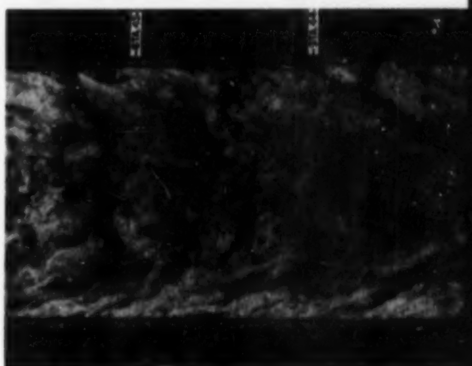
Concerning the phenomenon at a free surface, it was observed that this is not one of shear but rather one in which the turbulence projects portions of water into the air—thus causing entrainment. Reference was made to a criterion involving the turbulence, the gravitational force, and the surface tensions to indicate whether air entrainment would occur across a free surface. It was noted that this criterion is significant only in small-scale work. For scaling air-entrainment results, excellent agreement was noted between 6- and 60-in. siphons on the basis of the Froude law. And yet one would expect that Reynolds number scaling would become important if the conduit were long enough.

One problem mentioned, in which definite information is needed on the rate of entrainment, was that of water inlets from storm drains, in which flow through a grate produces many jets facilitating air entrainment. Discussion was also devoted to air entrainment caused by vortex motion at a conduit inlet, with particular attention to the morning-glory spillway. Some success in Froude scaling on this phenomenon was noted.

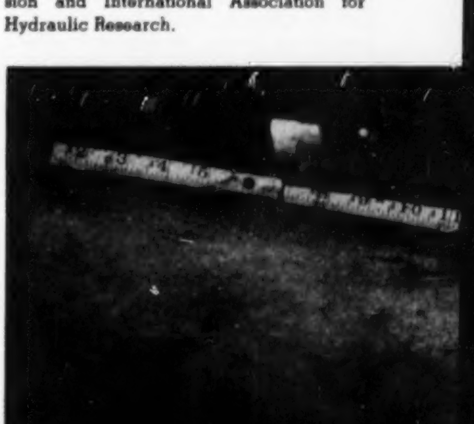
Discussion of the effect of aerated flow on hydraulic structures was concerned with three factors. (1) effect of air release on the structures; (2) effect of aerated flow on the performance of closed conduits; and (3) such effects on open-channel structures. There is obvious need for additional information on the rate at which air comes out of solution to apply to pipes in such applications as the discharge channel from a large underground power plant, and irrigation delivery structures or weir stands. In these problems it is vital to know how far downstream a pipeline must be vented to remove the air which has been entrained and which has later risen to the top of the conduit. In connection with the effect of aerated flow on closed conduit structures, it was noted that some difficulty may be experienced in getting agreement between model and prototype performance. This appears to be especially true when the flow develops as slugs or large bubbles in the pipe.

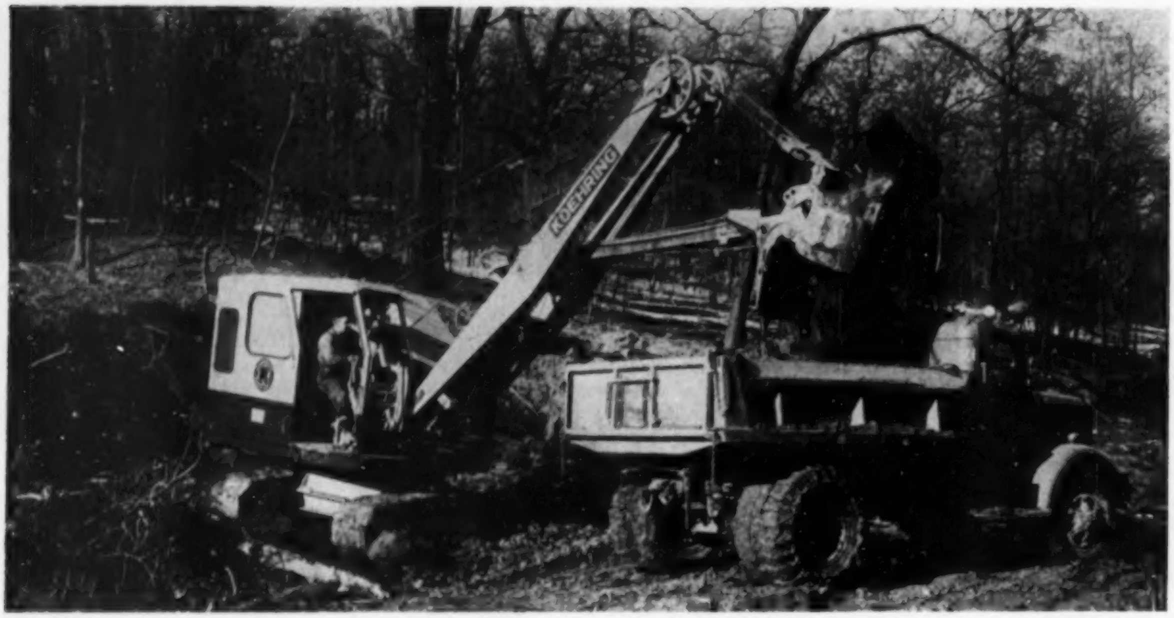
In the discussion of open-channel hydraulic structures, consideration was given to the occurrence of aerated flow in spillways. The work of Halbron in France and that of Bauer in the United States have essentially settled the two-dimensional problem of where aeration first occurs. In actual spillways there is a strong three-dimensional effect due to side walls or piers. In neither case can the rate of aeration be predicted. In spillways, chutes, and energy-dissipating devices, the freeboard allowance for air bulking needs more accurate prediction.

It was evident from the discussion that many aerated-flow problems are in need of further research. Besides need for study of the mechanics of the entrainment process, as well as the processes by which the air is kept in the water, many specific problems involving open and closed conduit structures are in need of further elucidation. Thus additional information on the rate of rise of air bubbles, especially in turbulent water, and the movement of air slugs along pipes is needed to help in locating air vents in pipes. In spillways and chutes, the effect of side walls in causing air entrainment is not adequately known.



Aerated flow in model flume is seen from above in upper photo, and from side in lower photo, both taken at St. Anthony Falls Hydraulic Laboratory and furnished by its director, Lorenz G. Straub, M. ASCE. This laboratory acted as one of the hosts to the hydraulics conference held jointly in Minneapolis, Minn., by ASCE Hydraulics Division and International Association for Hydraulic Research.





POWER CRANES AND SHOVELS

quick selection by charts and graphs

INFORMATION on equipment performance and first cost is here given in graphic form. A second article by Mr. Martinson, to appear next month, will deal with operating costs. The two articles together will present, in handy form, the information needed by the engineer and contractor in selecting power cranes and shovels for the particular job in hand.

E. O. MARTINSON, *President, Koehring-Waterous Ltd., Brantford, Ontario, Canada*

I. Capital investment and work capacity

Because of the great variety of work performed by excavators and the range of operating conditions, there seems to be no accumulation of consistent performance data as to output and operating costs. However, it is possible to make up logical synthetic cost data for definite operating conditions which can then be modified by the user as required.

The information on excavator performance here presented in chart form should aid in the quick selection of the proper size and type of excavator, and the suggested cost data, when modified by realistic efficiency factors, should give a fair idea of the estimated operating cost of power cranes and shovels so that the cost of excavation by this means can be compared with that by other methods. The main subjects to be covered are capital investment, work capacity, and operating costs. The first two are covered in the present article; operating costs will be discussed in a second article.

Excavators in the commercial range are usually available in the following sizes: $^3/_8$, $^1/_2$, $^3/_4$, 1, $1^1/_4$, $1^1/_2$, 2, and $2^1/_2$-cu yd capacities. The capacity rating is the size of the shovel dipper normally handled by the machine. Intermediate sizes such as $^5/_8$, $1^3/_4$ and 3 cu yd are occasionally used, and there are a number of sizes above the commercial range. For the most part the data will apply to excavating operations but they can also be used on other classes of work.

Excavators can be mounted either on crawlers, self-propelled rubber-tired mountings, or rubber-tired trucks having separate engines for traction. Crawler-mounted machines are better suited to excavating applications, whereas rubber-tired machines are used principally for lift-crane work, except possibly in the $^3/_8$-cu yd size, where most of the machines are rubber-tire mounted and are used for excavating. Since most of the machines used for excavating in the commercial range are crawler mounted, the data here presented are for that type of machine.

Three principal types of attachments are available for excavators—shovel, backhoe, and crane boom. The crane boom in turn is used for excavating by means of dragline buckets or clamshell buckets and for other miscellaneous lifting purposes such as for steel erection and for the handling of concrete buckets, pile-drivers, lifting magnets, breaker balls, and the like.

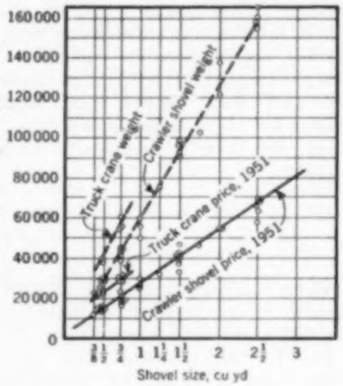


FIG. 1. Price curve shows average prices in dollars, and weight curve shows average weights in pounds, of several leading makes of excavators equipped with shovel attachments and diesel-engine powered. Corresponding curves for truck cranes are included for comparison. Curves are based on 1951 prices which, however, differ little from 1954 prices.

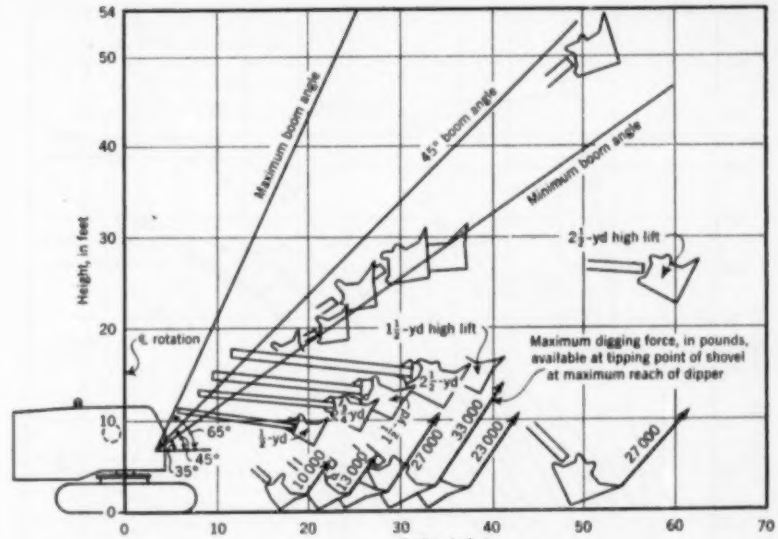


FIG. 2. Digging ranges of shovels are shown for four standard sizes and two high-lift sizes used in overburden stripping. Upper sketches locate approximate maximum heights of dippers when boom is at 45-deg angle. Lower sketches indicate approximate digging force at tooth point available at maximum reach.

First consideration—price

The first consideration in selecting an excavator is possibly the price (Fig. 1). Both price and weight seem to follow a fairly straight-line relationship for the various sizes of machines in the commercial range. The prices seem to range from about 55 cents per lb for the smaller crawler cranes, down to about 41 cents per lb for the $2^1/_2$-cu yd size.

Freight is part of the capital cost. It varies of course according to the distance from the factory. For a 2,000-mile distance, the railroad freight cost can amount to nearly 8 percent of the factory price of the shovel.

Second consideration—performance

The second factor in the selection of an excavator is its work capacity. There are three items of work capacity to be considered—range, lifting capacity, and hourly digging capacity. Range includes reach, lifting height, or digging depth. For lift cranes the lifting heigh'.

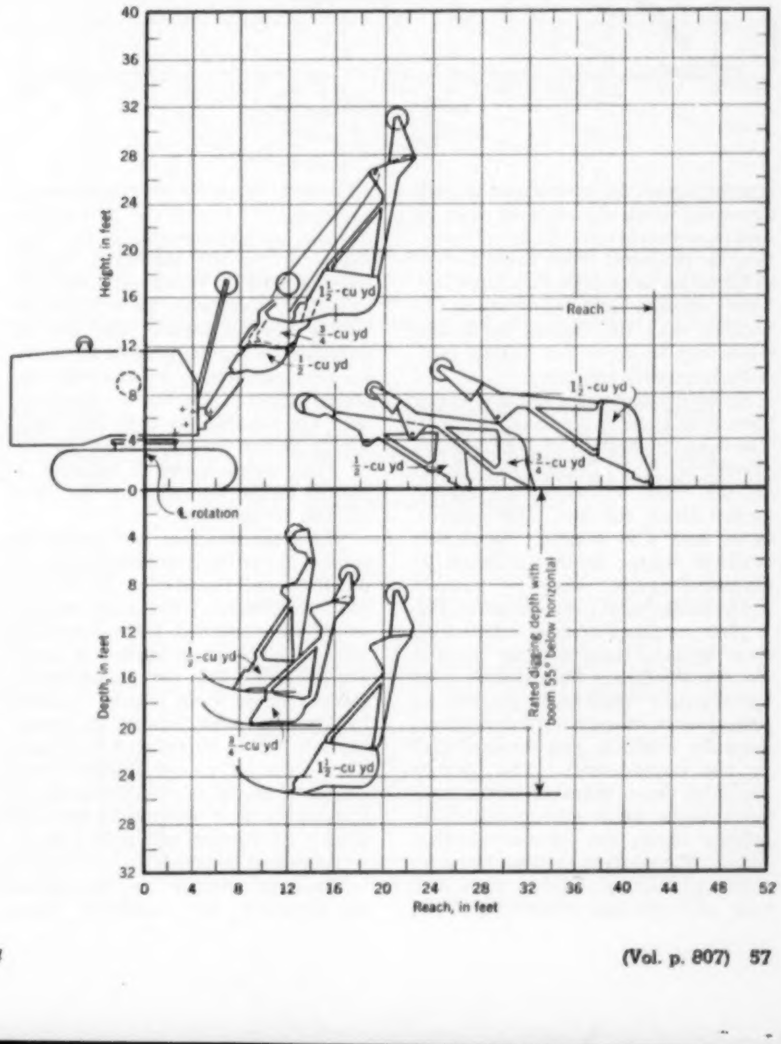


FIG. 3. Digging ranges of backhoes are shown for three most popular sizes. Upper sketches locate approximate m ximum height for dumping. Lower sketches show rated digging depth with boom 55 deg below horizontal.

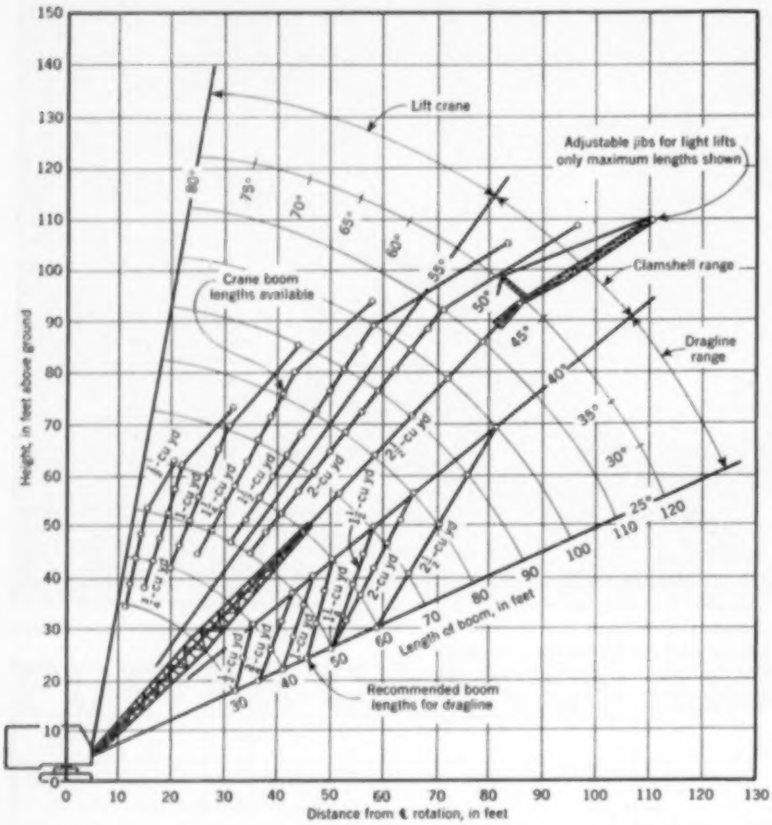


FIG. 4. Boom lengths of cranes, clamshells, and draglines are shown for various bucket sizes. Maximum recommended lengths are plotted as top point on diagram for each size. Shorter boom lengths shown for draglines are recommended to avoid too great a reduction in bucket capacity.

is an important factor and may of itself determine which size of crane must be used regardless of cost. In shovel operation, the reach and lifting range are not so important as perhaps the dipper size, hourly capacity, and digging power. In backhoe work the digging depth and reach may be important factors, especially in pipeline trenching.

Shovel digging ranges and the digging force at tooth point are shown in Fig. 2. The same information for hoes is shown visually in Fig. 3. Digging depth would be the most important information needed about the hoe. The relative boom and arm lengths, the lowest practical digging depth and height at discharge, may be visually compared.

The crane-boom range diagram, Fig. 4, gives considerably more information than the usual range diagram found in the manufacturer's bulletin. It plots the standard crane-boom lengths for each of seven different sizes of machines normally available and recommended by the manufacturer. The shortest length of boom indicated is the basic boom length, which is fairly well standardized among the various manufacturers. For example, the base boom for a 1-cu yd machine is shown to be 40 ft long, while the base boom for a $2\frac{1}{2}$-cu yd is 60 ft. Crane-boom extensions are available in 5-, 10-, 15- and 20-ft lengths to make up boom lengths in the steps shown up to the maximum usually recommended for crawler-mounted machines. Jib extensions are available for use on lift-crane booms. The jibs are adjustable in angular position for reaching over parapets or for extending the lifting height of the boom. However, they are suitable for light lifts only. The maximum jib length recommended in most manufacturers' bulletins is plotted as the top point on the boom diagram for each size.

This range diagram also shows the usual range of boom working angles for draglines and clamshells. Within the dragline portion of the chart, another set of recommended boom lengths is given which is more limited in range. For draglines it is not practicable to use the longer boom lengths available for lift-crane work because the bucket capacity would be reduced too much. Thus on a $2\frac{1}{2}$-cu yd dragline, boom lengths of 60, 70, 80, 90 and rarely 100 ft might be used, whereas for lift-crane work a 120-ft boom with a 30-ft jib extension could be permitted.

Then, in addition to the various recommended and available boom lengths, the reach and height above the ground for any boom can be determined as well as the approximate angle of the boom for that position. This part of the chart is useful for determining clearance height or lifting height.

The second item in the work capacity of a machine is its lifting capacity. Another combination chart, Fig. 5, consists of curves of approximate lifting capacity for seven sizes of machines. These curves are only approximate because the lifting capacity varies considerably among the various makes of machines depending upon the length of crawler and the counterweights, and the manufacturer's literature should be consulted for more accurate data. This chart is most useful as a comparison of the relative lifting capacities between sizes. The chart gives the lifting capacity for various distances from the center line of rotation of the machine. The safe lifting capacity is three-quarters of the actual tipping load. Therefore a crawler machine on a hard, firm surface will actually lift up to one-third more than this chart indicates.

Some manufacturers recommend that for clamshell and dragline digging, 67 percent, or two-thirds of the tipping load, be used for determining the weight of the loaded bucket, and the dashed line plots this capacity in the clamshell and dragline range.

The safe lifting capacity of the machine at a 12-ft radius might be generally considered to be the rated lifting capacity of the machine in tons when equipped as a crane. Thus, the $\frac{3}{4}$-cu yd excavator of this chart might be classed as a $13\frac{1}{2}$-ton crane, and the $1\frac{1}{2}$-cu yd excavator could be classed as a 36-ton crane. These tonnage ratings will again depend on the length of the crawlers, the size of the counterweights, and the weight of the machine.

The lifting-capacity chart also shows the maximum hoist-line pull available at full engine horsepower for each of the seven sizes shown. The recommended line pull used in hoisting or lifting work is less than the maximum available line pull in order to provide spare power for accelerating the load or for swinging the machine. Also, the safety factor of the cable at full engine power is not adequate for steady lifting. The chart

shows the safe lifting range for a single hoist line and the range where a two-part, three-part, or four-part hoist line would be recommended. More than four parts of line should be provided for the heavier lifts on the larger machines.

By using Figs. 4 and 5 in combination, it is a simple matter to determine the weight of the loaded clamshell bucket or the weight of the loaded dragline bucket that can be used for any size of machine and any desired working radius or boom length. It is only necessary to know the weight of the loaded bucket in order to determine the size of bucket that might be used. Dragline bucket weights are shown in Fig. 6, and clamshell bucket weights in Fig. 7.

These charts make it evident that the shortest possible boom should always be used to obtain the greatest lifting and digging capacity. Another reason for using short booms is that the energy absorbed and the resulting heating of the swinging clutches varies as the square of the radius of the load. The operator may have to reduce his swinging speed when handling a loaded bucket out at the maximum radius to prevent the swing clutches from becoming overheated.

The third item included under the subject of work capacity is the digging capacity in cubic yards per hour. Tables I and II show hourly shovel and dragline digging capacities for nine sizes of dippers and buckets for handling several classes of material. These tables are condensed from data presented by the late A. E. Holcomb, a former Sales Manager of the Koehring Machine Company, Milwaukee, Wis., in a paper before the ASCE Annual Convention of 1931. These data are also contained in expanded form in recent publications of

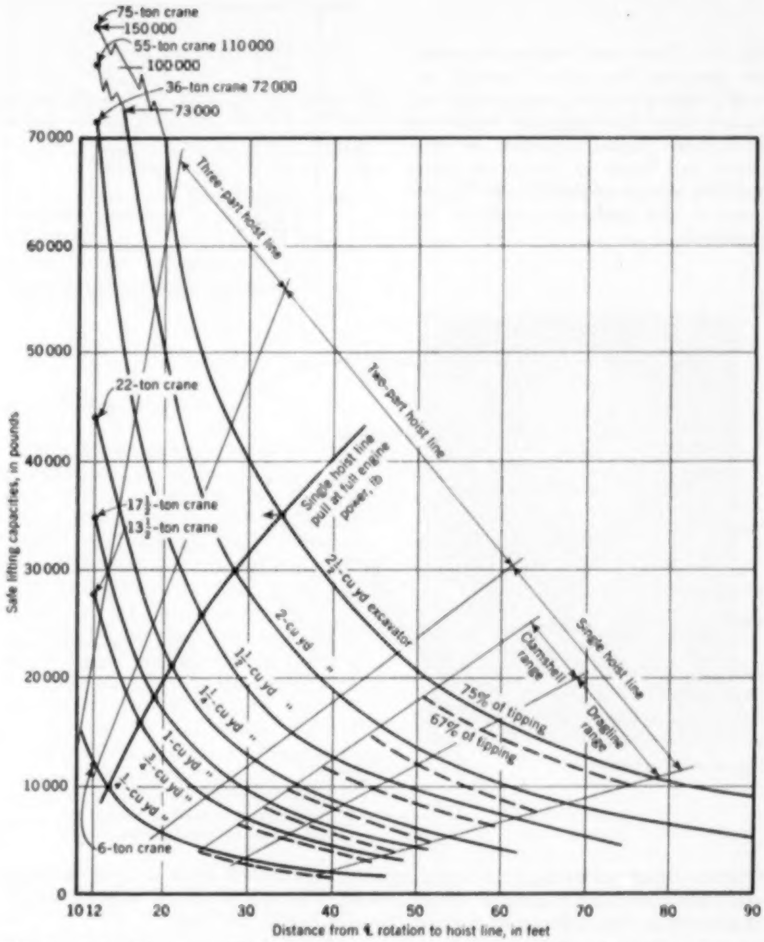


FIG. 5. Safe lifting capacities are shown for seven excavator sizes. Capacities are approximate only, because length of crawler, counterweights, etc., have considerable effect. Chart shows usual range for dragline and clamshell operation, conditions requiring two or more parts in hoist line, maximum available line pull and tonnage rating at 12-ft radius.

FIG. 6. Operating weights of dragline buckets are shown, assuming that buckets are loaded to rated capacity with earth or gravel weighing 100 lb per cu ft, or 2,700 lb per cu yd. Prices have not changed substantially since 1951.

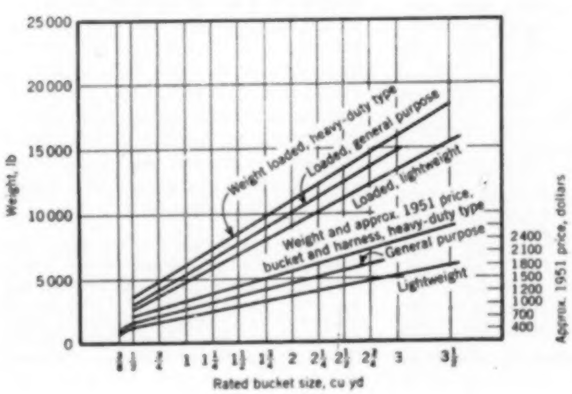


FIG. 7. Operating weights of clamshell buckets are shown, assuming that buckets are loaded to rated capacity with earth or gravel weighing 100 lb per cu ft, or 2,700 lb per cu yd. Prices have not changed substantially since 1951.

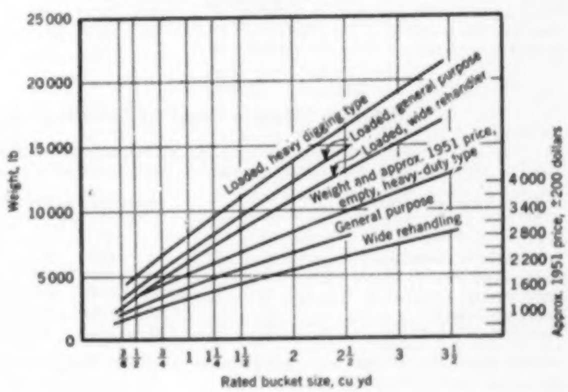
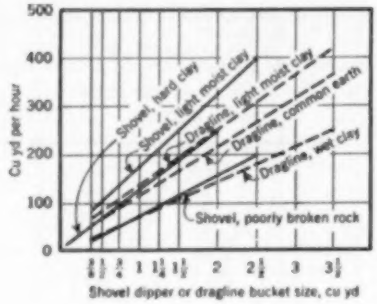


FIG. 8. Shovel and dragline capacities are compared, for various types of material. Solid lines show shovel capacities; dashed lines show dragline capacities. Since these digging capacities are theoretical, and based on continuous operation, they must be modified by an efficiency factor to suit particular conditions encountered.



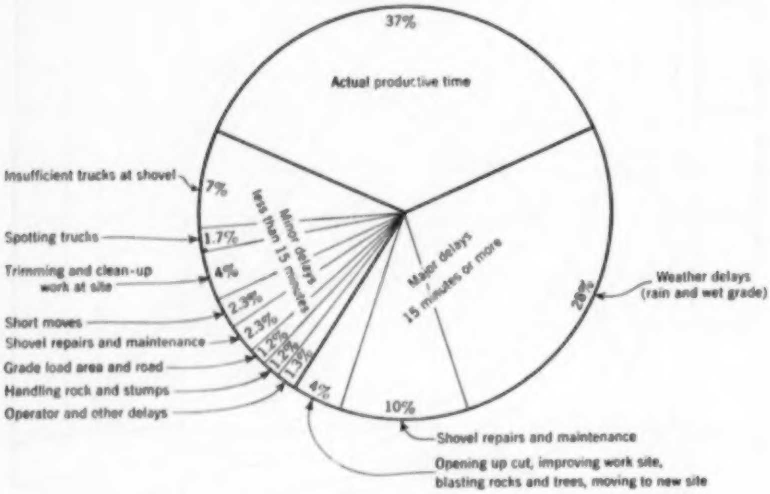


FIG. 9. Delays encountered in shovel operation are broken down to show causes of major and minor work stoppages. Graph represents average of data on 16 power shovels at 10 highway jobs, collected by Highway Research Board, 1947–1949.

TABLE I. Hourly shovel digging capacity

Bank measurement in cu yd per hr, no delays, best digging depth, 90-deg swing, all materials loaded into hauling units

Class of Material	Shovel Dipper Size, Cu yd								
	3/8	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/2
Moist loam or sandry clay	85	115	165	205	250	285	320	355	405
Sand and gravel	80	110	155	200	230	270	300	330	390
Good common earth	70	95	135	175	210	240	270	300	350
Clay, hard, tough	50	75	110	145	180	210	235	265	310
Rock, well blasted	40	60	95	125	155	180	205	230	275
Common, with rocks and roots	30	50	80	105	130	155	180	200	245
Clay, wet and sticky	25	40	70	95	120	145	165	185	230
Rock, poorly blasted	15	25	50	75	95	115	140	160	195

TABLE II. Hourly dragline handling capacity

Bank measurement in cu yd per hr, no delays, best digging depth, 90-deg swing, all materials loaded into hauling units

Class of Material	Dragline Bucket Size, cu yd*								
	3/8	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/2
Moist loam or sandy clay	70	95	130	160	195	220	245	265	305
Sand and gravel	65	90	125	155	185	210	235	255	295
Good common earth	55	75	105	135	165	190	210	230	265
Clay, hard, tough	35	55	90	110	135	160	180	195	230
Clay, wet and sticky	20	30	55	75	95	110	130	145	175

* Dragline bucket size may be larger than machine rating. Thus a 2-cu yd dragline bucket might be used on a 1 1/2-cu yd excavator.

the Power Crane and Shovel Association. The theoretical hourly yardages must be modified for different angles of swing, higher digging faces, and types of use, whether for casting or loading trucks.

The hourly yardages of shovels and draglines are compared in graphic form in Fig. 8. It should be emphasized that these digging capacities are theoretical, based on continuous operation of the machine, without any delays. Since delays of one type or another will inevitably occur, these theoretical digging capacities must be modified by an efficiency factor. The actual hourly output and the unit cost of operation will depend upon this efficiency factor, and the accuracy with which this factor is estimated will depend upon the experience and judgment of the estimator.

Some idea of the kinds of delay involved and the possible extent of these delays is given by Fig. 9. This chart is based on data presented in a bulletin of the Highway Research Board, which is a record of the average actual performance of 16 power shovels of various makes, ages, and sizes, working on 10 different highway jobs from 1947 to 1949. The average actual digging time in these studies was only 37 percent of the total time. Some jobs must have been much worse than this, and others better.

It can be seen that weather was the greatest single cause of delay, averaging 28 percent of the total time. This factor may not apply in a stone-quarry operation or on a drainage canal being dug by dragline. Shovel repair and maintenance shows a time loss of 10 percent of the total due to delays of 15 minutes or longer, plus 2.3 percent for minor delays of less than 15 minutes, or a total of 12.3 percent. This factor depends on the age of the machine, and a good deal on the operator. The next largest cause of delay seems to be waiting for trucks, and this factor also would not apply in certain types of operations.

Operating efficiency is further affected by the skill and integrity of the operator. He could limit his output in a number of ways so that he would not set too high a performance standard for himself. Also the operator will have a great deal to do with the amount of maintenance required to keep a machine running according to the smoothness with which he handles it. A skilled operator can prevent shocks and overloads on the machine, and can reduce cable wear and breakage.

(This article is based on the paper presented by Mr. Martinson at the ASCE Annual Convention, before the Construction Division session devoted to "The Use of Construction Equipment—Choice, Capacities, Economy," presided over by Warren N. Riker, M. ASCE, and Walter L. Couse, M. ASCE.)

The pipeline carries the punch

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During the past two decades, engineers in the construction industry have been building the great pipeline systems that thread across the country. The visible benefits accruing to industry from these pipelines and the fascination of constructing them against time and the elements have captured the imagination of construction and oil men alike. To military engineers, these benefits have assumed an almost epic significance, for in any future war, the ability of the Armed Forces to move and maneuver will depend on petroleum products flowing from pipelines.

Atomic warfare, whether for attack or defense, means movement—dispersion, speed. No longer do we dare mass whole armies on a single beach or around a single port where they can be annihilated with a single nuclear blow.

Even in the relatively ground-bound days of World War II we learned that only with pipelines could we keep petroleum products flowing to ground and air forces in the huge quantities required for telling strikes and rapid thrusts in all quarters of the world. Simultaneously it became vitally necessary to add to our domestic petroleum transport the capacity to keep the home front producing as we fought and supplied a global war. But the petroleum needs of the last war were indeed only a fraction of those we foresee should we become engaged in another world conflict.

From the top down, the Army's leaders must either possess themselves, or avail themselves of the best engineering and scientific counsel and know-how our civilization can provide. Today's armies require participation at all levels by science and engineering—including construction. The saying, "Modern war is an engineering war," is not a mere slogan, but a proven truth from which the potential capability of each of our Armed Forces may be measured. The Armed Force that gives only lip service to this truth and denies the same incentive and prestige to its technical branches that it accords to its combat elements will not long survive.

Skyrocketing fuel needs

Since World War II, fuel needs have skyrocketed. For example, the M-4 medium tank of World War II used 125 gal of gasoline for each 100 miles; today's M-47 medium tank uses five times that quantity. All our ships consume liquid fuels in ever increasing quantities. As for airplanes, the C-99 cargo plane can carry 400 men or 50 tons of freight but uses enough gasoline on a single long flight to last the average automobile owner all his life. Today's B-52 is twice as fast as the B-29 of World War II, and today's B-47 medium bomber flies faster than the fastest fighter of World War II; but each increase in speed is accomplished at the cost of tremendous increases in fuel requirements. Our fleets of bombers as well as our industrial complexes must be defended with swift jet fighters. Today's jets use four times as much fuel as the jets we had at the end of the recent war. Tomorrow's fighter-plane fuel needs can only be conjectured, but we know that experimental planes have reached about twice the speed of sound.

To back our striking and defensive power, we must keep up our production at home—possibly under improvised circumstances. It may be necessary to disperse our plants, which will require fuel supplies that are flexible and mobile, and in many instances this requirement can best be met by pipelines.

In the field, pipelines can come almost to the front. In fact, from the standpoint of military logistics, pipelines are essential for a rapid advance deep into war-torn territory. There is a distance beyond which trucks and planes cannot transport fuel without consuming more than their payload. When General Patton's Third Army ran out of gas near Metz, it was supplied by truck only at a fantastic cost in fuel. His experience emphasized the point that as a practical matter, ground forces cannot move forward unless railroads or pipelines keep pace, and pipelines require much less manpower, material, and time than railroad construction. Time and again during the war we brought pipelines even within artillery range of the enemy.

In the fast-moving wars of the future, pipelines may not always be able to follow that closely. It is all the more important, therefore, to plan the construction of military pipelines as integral elements of the strategic and logistic plan, with trunk lines to main strategic areas, ready for feeder lines to branch out to local distribution points as the need develops.

Perhaps we can derive some estimate of military pipeline needs in the atomic age by extrapolating from the experience of World War II. On August 24, 1944, the U. S. First Army alone burned up approximately 800,000 gal of gas, and the First was only one of five armies in the field in Europe alone. Between D-Day and VE-Day, pipelines carried almost all of the 1.7 billion gal of motor gas, aviation gas, and diesel fuel used by our forces in Europe. That stupendous total was for the European theater alone, for the period after the landing in Normandy, and for a war in which the fuel requirements were but a fraction of the needs of today.

It was back in World War I that we began to realize that battles are fought with petroleum, and that without petroleum a war can be lost. The final German offensive in World War II, called the Battle of the Bulge, in December 1944, had as its

ultimate objective a push to the sea, but as one of its main immediate objectives the capture of fuel. As it happened, between the two little villages of Stavelot and Spa, some 40 miles southeast of Liège, we had a great POL dump containing something like 2 million gal of gasoline, more than 20 times the amount the Germans had when they launched their attack. They had to have that fuel to succeed. Working frantically day and night, our troops removed most of it during the first three days of the offensive. You know what happened. Beyond that empty dump, the German tanks ran out of gas. And the whipped Germans headed back into their homeland.

No wonder that oil was a major strategic objective during World War II!

Unlike our enemies, in World War II, we had the greater reserve of oil. But we found our ability to exploit this advantage was governed not by our productive capacity but by the effectiveness of our transportation facilities.

A military pipeline differs materially from commercial lines. The tubing must be at least light enough to permit two men to handle each 20-ft section, and sections must be joined by a flexible coupling rather than by a welded joint. These modifications are typical of the application of any technological development to the practical consideration of war logistics and the battlefield.

We were ordered to construct a line in North Africa before we had even tested our new procedures or materials. The line we built was in many respects improvised. Much of the pipe was damaged in unloading and by rough handling; yet this too must be expected in war, where the elements of time, the enemy, and nature itself are ruthlessly arrayed against you. Nevertheless, the 777-mile line we laid has been termed "one of the outstanding achievements of the war." It met the fundamental test—it delivered the goods under battle conditions.

Naturally there were many kinks still to be worked out, with the help of American industry and the technical ingenuity of our men at all levels of work. There are still kinks to be worked out, and there probably always will be. Nevertheless, ever since Morocco, the Army and the Air Force have fought from the business end of pipelines.

Meanwhile, back at home the nation was facing not so much a petroleum crisis as a petroleum-transport crisis. Before Pearl Harbor, about 95 percent of all the petroleum needs of the East Coast were supplied by tankers, which came over the open sea from the Gulf, from California, and from abroad. Then came the submarine blockade, deadlier than many people recognized at the time. Strict gas rationing was imposed, and still a critical petroleum shortage developed in our Eastern centers of population, production, and trade. The American people were shocked to find that their nation, which had half the entire world's crude oil production within its own borders, was running out of gas.

That was how the Government got into the pipeline business. Many will remember the frantic rush to complete the Big Inch and Little Big Inch pipelines connecting the oil fields of Texas with the oil users on the eastern seaboard. More than 8,500 miles of new pipeline were laid in this country during the war, plus 3,200 miles more that were dug up and relaid, plus another 3,300 miles for which the direction of flow was reversed.

We do not and we cannot rely exclusively on pipelines but they have inherent advantages which rank them first when they are adaptable to the particular logistics problem in hand. Our domestic pipelines are almost always well underground, virtually immune to enemy air attack. The weather has little effect on them. While ice closes important sections of the inland waterways, slows down trains, and jams the highways, oil moves through pipelines with a minimum of maintenance. Their economy, speed, and convenience are demonstrated by the fact that more than 13 percent of the total ton-miles of all public and private freight in America now goes through pipelines and that pipelines have become the third largest form of commodity transportation in the nation, though their traffic is specialized. Today a gallon of crude oil can be carried over land by pipeline a thousand miles for a penny—economy which almost matches the average of water transportation but across areas where the latter is not available.

More recently, the Korean war has given us some opportunity to measure the changes that have occurred since World War II, particularly in the field of supply; and again pipelines came to the fore. When hostilities broke out, we found that West Coast industry and our commitments in the Pacific required for purely military purposes the full West Coast production. It therefore became necessary to ship some 100,000 bbl a day from the Gulf area through the Panama Canal. Up in Canada, however, the rich fields near Edmonton in Alberta were producing plenty of oil. The result was the 24-in. Trans-Mountain Pipeline, built at a cost of $93 million with a capacity of 120,000 bbl of Edmonton crude a day to serve Canadian refineries near Vancouver and American refineries under construction north of Seattle.

The Korean war fortunately remained a local one; but the pipeline preparations thus made for possible expansion of the conflict remain permanent assets to our nation, valuable to our economy, and vital to our defense by providing both greater flexibility and greater capacity in continental distribution.

What of the future? Certainly this petroleum age will extend as far as we now can see. In 1914, America produced 728,000 bbl of petroleum a day; last year, we produced more than 7 million bbl a day. In 1914 only 4 percent of the world's merchant fleet ran on oil; now the figure is more than 51 percent. Railroads and towboats have turned to diesel in overwhelming proportion. So has most of our heavy construction machinery. By 1975, according to the President's Materials Policy Committee, we will need twice as much petroleum as we are now using to supply peacetime needs alone.

Our mobilization plans include the use of all existing cross-country pipelines. We count on them to carry the load of 300 T-2 tankers or their equivalent that will be immediately put into overseas service if war comes.

Two strategic pipelines

Meanwhile, we are right now building two great pipelines of basic military significance. One is to supply our troops in Europe, should they ever have to help defend the western part of the continent from attack. This pipeline runs across France, from St. Nazaire on the Atlantic seaboard some 200 miles to Metz. It is being built with U. S. dollars by French contractors under American Army Engineer supervision.

The other pipeline is being built in Canada and Alaska. As far up the coast as Haines, Alaska, ships have a sheltered passage behind the coastal islands. In this stretch not only tankers but barges can ply with relatively little fear of submarines. The southern terminus of the coastwise passage is abundantly supplied with oil from Alberta via the Transmountain Pipeline. A pipeline has now been launched from the northern end, from Haines—to bring vital fuel to the planes that scan the Arctic skies and to the men who fly and serve them at bases in the Yukon Valley.

The builders are fighting their way through some of the toughest mosquito country in the world, laying seamless pipe across muskeg swamps where the season-to-season temperature varies as much as 170 deg. The country is wild, broken, and in places mountainous. Work goes on at all seasons but most of it is done during the howling winter months, the only time when trucks and equipment can cross the swamps. Welds must be adapted to temperatures of 70 deg below zero. When completed, the Haines-Fairbanks pipeline will be 615 miles long, with approximately half its distance in Canada. A Canadian company is working with two American companies to see it through.

The Army Engineers are striving constantly to improve our pipeline program and to make it more responsive to the demands that will be placed upon it, in so far as we can foresee them. At present we are using standard lightweight steel pipe which has been improved for our purposes and made up into kits for easy delivery to the field. But we continue to seek more speed, less weight, greater portability, and greater simplicity in pipeline construction. We have tried magnesium pipe, aluminum pipe, plastic pipe, and even glass pipe. We have experimented

with laying flexible pipe directly from trucks and even from helicopters.

We are working now on a new gas turbine weighing only 500 lb which, we hope, will enable us to reduce the weight of our pumping stations from 15,000 lb to only 1,000 lb, and which can be delivered by small aircraft. We have already adopted as an item of issue a 10,000-gal rubber storage tank which has proved satisfactory in tests from the Arctic to the tropics.

In short, we have only one pipeline policy, and it is that we must *never* be satisfied; we must *always* improve. Since the Corps is not primarily a research agency, for the advances we need we rely upon the inventive genius, the progressiveness and enterprise of American industry. And in the field of pipelines, it is largely up to engineers who are professional pipeline experts and their associates in the pipeline industry to insure the adequacy of our network at home, and to help us of the Corps of Engineers to keep oil and gas flowing to all the fighting fronts of the world under any circumstances that may confront us.

It is reassuring to know that engineers in private enterprise are going to work with the Corps of Engineers in the future as they have in the past—in research, in planning, and on many an important construction job. And I know that to these engineers, as to us, the partnership will not be a mere business transaction but will be rich with the adventure and the sense of achievement that men feel when they are unselfishly devoted to the cause of strengthening and defending their homes and their country.

FIELD HINTS

Reinforced concrete culvert pipe cut by explosives

A method of cutting reinforced concrete culvert pipe in the field with explosives is currently being subjected to experimentation by the United Concrete Pipe Corporation at its Baldwin Park, Calif., plant. Preliminary results indicate that this may be a faster and cheaper method.

It is believed that J. A. Payton, a contracting firm of Riverside, Calif., was the first to successfully cut concrete pipe with explosives in this manner, having adapted the procedure from the firm's customary practice of cutting obstructing rocks with primercord.

United Concrete Pipe Corporation has conducted experiments with various sizes of reinforced concrete culvert pipe with varying wall thicknesses, with the assistance of Jack Cunningham of the Atlas Powder Company. Atlas 100-grain primercord was used and detonated with electric blasting caps. The primercord must be carefully wrapped around the pipe, especially for a miter cut. Varying numbers of turns of the primercord around the pipe and the position of the cord, that is, side by side or on top of other turns, were found to be very important in producing the desired amount of fracture in each size of pipe. The blast travels through primercord at an approximate speed of 18,000 ft per sec, producing an instantaneous effect. A distinct, clean crack can be obtained completely around the inside of the pipe to permit chipping away the concrete and cutting the reinforcing steel within a one-inch area, leaving a clean-cut edge.

It is estimated that cutting concrete pipe in this manner will save 75 to 80 percent of the labor costs involved in the current method of using an airhammer, or a hammer and chisel, which requires a cut of 4 in. in width and leaves a jagged edge to be smoothed.

Cutting concrete pipe with explosives apparently is faster, cleaner, and possibly cheaper than the usual methods, but it does have the obvious drawbacks of noise, concussion, and the dangerous characteristics inherent in any explosives operation.

In preparation for miter cut, primercord is wrapped around 72-in. reinforced concrete culvert pipe (left). After detonation (center), clean, distinct crack completely encircled pipe on inside and no other cracks were found. Blast of primercord has severed 36-in. reinforced concrete culvert pipe (right), breaking all longitudinal reinforcement and leaving only circumferential rod intact.

ENGINEERS' NOTEBOOK

Hydraulic drop as a function of velocity distribution

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The hydraulic drop is a rather unspectacular phenomenon when compared with its cousin, the hydraulic jump. It is also less easily analyzed. In consequence, a relatively small amount of literature has been devoted to it; and such experimental data as can be found are so much at variance, that one is tempted to attribute free will to the water droplet after the fashion of the atomic physicist. The present paper brings these seemingly contradictory observations into focus by giving velocity distribution its proper due.

In brief review, most work on the hydraulic drop has been expressly limited to the free outfall from a rectangular channel of mild slope. Free outfall implies a ventilated jet with the entire nappe at atmospheric pressure. A channel of mild slope is one in which critical depth is less than the depth of uniform flow. Under such conditions, the typical investigator has sought to establish a fixed ratio between the outfall depth, D_f, and the critical depth, D_c. M. P. O'Brien (*Engineering News-Record*, Sept. 15, 1932, p. 313) appears to have the lowest value on record. Working from the impulse-momentum relationship, he obtained

$$D_f/D_c = 2/3$$

with an experimental verification of 0.643. At the other extreme, Hunter Rouse (Civil Engineering, April 1936, p. 257) employed Francis's weir formula to yield

$$D_f/D_c = 0.715$$

with experimental confirmation at 0.716. Unmoved by the local correspondence between fact and theory, the neutral reviewer concludes that

$$0.64 \leqslant D_f/D_c \leqslant 0.72$$

with a rather generous spread. Clearly, the ratio is not fixed.

To resolve the problem, let Bakhmeteff's specific energy head be expressed as follows:

$$H = y + \frac{p_v}{\rho g} + h_v$$

Under conditions of uniform flow, $a = 0$, so that

$$p_v = \int_y^D \rho g\, dy = \rho g(D - y)$$

$$h_v = \frac{\int_0^D {}^1\!/_2 \rho v^3\, dy}{\int_0^D \rho\, g\, v\, dy} = \frac{\int_0^D v^3 dy}{2g\, VD} = \frac{\alpha V^2}{2g}$$

where

$$\alpha = \frac{\int_0^D v^3 dy}{V^3 D}$$

For non-uniform flow, however, $a \neq 0$; and under the conditions represented in Fig. 1,

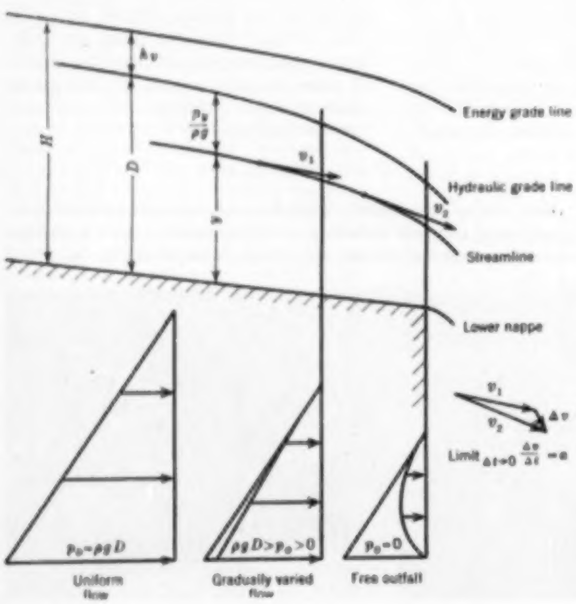

FIG. 1. Pressure variations due to accelerated flow in a hydraulic drop.

$$p_y = \int_y^D \rho(g \rightarrow a)dy = \rho \int_y^D (g \rightarrow a)dy$$

$$h_v = \frac{\int_0^D v^3 dy}{2\left[\int_0^y (g \leftrightarrow a)v\, dy + \int_y^D g v\, dy\right]}$$

with the validity of the vector operations temporarily open to question.

For uniform flow, with y equal to 0 and D in that order, the specific energy head reduces to

$$\frac{p_0}{\rho g} + \frac{\alpha V^2}{2g} = D + \frac{\alpha V^2}{2g}$$

with $p_0 = \rho g D$ as in hydrostatics. For the flow conditions of Fig. 1, the corresponding equation becomes

$$\frac{\rho \int_0^D (g \rightarrow a)dy}{\rho g} + \frac{\alpha V^2}{2g} = D + \frac{\int_0^D v^3 dy}{2\int_0^D (g \leftrightarrow a)v\, dy} \quad (1)$$

since p_0 is everywhere less than $\rho g D$. So much for the vector subtraction. To make up the deficit,

$$\frac{\alpha V^2}{2g} = \frac{\int_0^D v^3 dy}{2\int_0^D g v\, dy} > \frac{\int_0^D v^3 dy}{2\int_0^D (g \leftrightarrow a)v\, dy}$$

which confirms the vector addition.

Equation 1 is generally of little practical value because of the multifarious variations in a. At the fall, however, $p_0 = 0$, so that

$$\int_0^D (g \rightarrow a)dy = 0$$

whence

$$\int_0^D (g \leftrightarrow a)v\, dy = 2g\, VD$$

and Eq. 1 reduces to

$$\alpha_f \frac{V^2}{2g} = D_f + \alpha_f \frac{V^2}{4g}$$

whence

$$D_f = \alpha_f \frac{V^2}{4g} = \alpha_f \frac{q^2}{4g\, D_f^2}$$

$$D_f^3 = \alpha_f \frac{q^2}{4g} \quad (2)$$

The equation for critical depth is written

$$D_c^3 = \alpha_c \frac{q^2}{g} \quad (3)$$

A combination of Eqs. 2 and 3 yields

$$D_f/D_c = \sqrt[3]{\frac{\alpha_f}{4\alpha_c}} \quad (4)$$

thus establishing the depth ratio as a function of velocity distribution.

Numerous data exist which indicate that the velocity profile in open channel flow may be fairly well approximated by a parabola with its vertex at or below the water surface. The curvature of the stream lines in Fig. 1 would further indicate an upward displacement of that vertex as the cross-section approaches the fall, thus

$$1 < \alpha_c < \alpha_f$$

For highly turbulent flow with all α's approaching unity, it follows that

$$(D_f/D_c)_{min} = \sqrt[3]{1/4} = 0.630$$

just short of O'Brien's experimental value.

To facilitate further discussion, let y_m represent the vertex depth for the specific parabola used in defining a velocity profile. Where y_m is greater than D, there can be no maximum velocity in the mathematical, sense, and the surface velocity becomes the apparent maximum. For $0 < y_m \leqslant D$, however, the maximum velocity actually occurs at y_m. It can be shown that α becomes minimum when $y_m \approx 0.6D$, the absolute location depending on the degree of turbulence.

Since critical depth implies minimum H, α_c must also be minimum. At the outfall, $y_m > D$, so that α_f tends to be maximum. For laminar flow, it can be shown that

$$\alpha_{min} = \frac{41 - 6\sqrt{21}}{10} = 1.35 \text{ at } y_m = \left(\frac{1}{2} + \frac{\sqrt{21}}{42}\right) D$$

$$\alpha_{max} \rightarrow 2 \text{ as } y_m \rightarrow \infty$$

whence

$$(D_f/D_c)_{max} = \sqrt[3]{\frac{\alpha_{max}}{4\alpha_{min}}} = 0.718$$

just beyond the experimental value obtained by Rouse. There being very few observed data on the velocity distribution at outfall sections, α_f may actually be in excess of 2, thereby providing for a possible increase in the absolute maximum for D_f/D_c.

The range for D_f/D_c having been established, the following approximation is offered for engineering practice.

$$D_f/D_c \approx 0.63 + 0.13\left(\frac{V - v_o}{V}\right)^2, v_o > 0.4V \quad (5)$$

where v_o is the so-called boundary velocity, the local velocity at the channel bottom. In the use of approximation 5, the values of V and v_o may be taken at any depth, even the depth of uniform flow.

For the reader who agrees with Boussinesq in the contention that

$$h_v = \frac{\beta V^2}{2g} \text{ where } \beta = \frac{\int_0^D v^2 dy}{V^2 D}$$

any change in specific energy head must always be in error by the head loss due to internal friction, so that the problem reduces to one of momentum exchange. For laminar flow, it can be shown that

$$\beta_{min} = 9/8 \text{ at } y_m = (3/5)D$$

$$\beta_{max} \rightarrow 4/3 \text{ as } y_m \rightarrow \infty$$

whence

$$(D_f/D_c)_{max} = \sqrt[3]{\frac{\beta_{max}}{4\beta_{min}}} = 2/3$$

which is exactly what O'Brien got by an entirely different approach. That the maximum value of D_f/D_c on the basis of β is significantly less than Rouse's experimental value would indicate that Coriolis is closer to the truth than Boussinesq.

Notation

H = specific energy head
y = local depth
y_m = local depth at maximum velocity
D = total depth
D_c = critical depth
D_f = outfall depth
p_y = local pressure
ρ = density
t = time
v = local velocity
v_o = local velocity at channel bottom
V = mean velocity
a = local acceleration
g = acceleration of gravity
h_v = velocity head
α = Coriolis coefficient
β = Boussinesq coefficient
q = discharge per unit width

Continuous beams analyzed by slope increments

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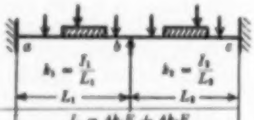
There is nothing new in the use of slopes to calculate bending moments in indeterminate structures. Yet the fundamental ideas underlying much-used tools are worthy of repeated clarification and discussion. In the presentation which follows, the moments at supports of continuous beams are calculated from fixed-end moments by using the concept of stiffness and carry-over factors of Prof. Hardy Cross, Hon. M. ASCE, but by means of the successive approximation of slopes rather than of moments.

The mechanics of Professor Cross's moment distribution have become fixed in the minds of many designers as a series of mechanical operations. As a result, the configuration of the structure as it relaxes into its final position of equilibrium is lost in the routine of arithmetical operations. It is possible, of course, to check the positions of tangents at the supports of continuous beams and at the intersections of the members of frames at each balance of moments in the process of distributing the moments. Although the changing position of the tangent is implied in moment distribution, the designer is not always aware of this implication.



Joint stiffness	$J_b = 4k_1E + 4k_2E$			
Fixed-end moment	M_{ab}'	M_{ba}'	M_{bc}'	M_{cb}'
Slope at b	$\theta_b = \frac{-M_b'}{J_b} =$		$\frac{-(M_{ba}' + M_{bc}')}{J_b}$	
Moments caused by θ_b	$2\theta_bk_1E$	$4\theta_bk_1E$	$4\theta_bk_2E$	$2\theta_bk_2E$
Final moments	$M_{ab}' + 2\theta_bk_1E$	$M_{ba}' + 4\theta_bk_1E$	$M_{bc} + 4\theta_bk_2E$	$M_{cb} + 2\theta_bk_2E$

FIG. 1. Direct calculations for slope θ_b and beam moments.

Professor Cross has stated, "Slope deflection has more than justified its place in America and Mr. Downey has made a valuable addition to the literature" ("Analysis of Continuous Frames by Distributing Fixed-End Moments," ASCE *Transactions*, Vol. 96, 1932, pp. 1–156). In view of this statement it may appear redundant to present once again a different version of an old idea, yet the following analysis may help to clarify the problem.

Following Professor Cross's concept of beam stiffness, the stiffness of beam ba (Fig. 1) relative to the end b, as applied to prismatic beams, is $S_{ab} = \frac{4EI_1}{L_1}$. The corresponding stiffness for beam bc is,

$$S_{bc} = \frac{4EI_2}{L_2}$$

Defining the stiffness of a beam at a point over a support as the moment required to produce a unit rotation of the beam at that point with the beam fixed at adjacent supports, then $J_b = S_{ab} + S_{bc}$, where J_b denotes joint stiffness. For $k_1 = I_1/L_1$ and $k_2 = I_2/L_2$, then $J_b = 4Ek_1 + 4Ek_2$. If the end c of the beam bc were simply supported, $J_b = 4EK_1 + 3Ek_2$. For simple supports at both ends a and c, $J_b = 3Ek_1 + 3Ek_2$.

Now suppose that the unbalanced restraining moment at joint b in Fig. 1 is M'_b. This unbalanced restraining moment is equal to the algebraic sum of the fixed-end moments at b in beams ba and bc. Restraining moments are positive when clockwise and negative when counterclockwise. With the ends a and c held fixed against rotation,

$$M'_b + J_b\theta_b = 0$$

From which, $\theta_b = \frac{-M'_b}{J_b}$

where θ_b is the final slope at b. Positive values of θ_b indicate a clockwise rotation of the tangent at b from its initial position. Negative values of θ_b indicate a counterclockwise rotation of the tangent.

When the angular rotation θ_b occurs, carryover moments are induced at the ends a and c equal to $2\theta_bk_1E$ and $2\theta_bk_2E$, respectively. The final moments are then obtained directly:

$$\begin{aligned} M_{ab} &= M'_{ab} + 2\theta_bk_1E \\ M_{ba} &= M'_{ba} + 4\theta_bk_1E \\ M_{bc} &= M'_{bc} + 4\theta_bk_2E \\ M_{cb} &= M'_{cb} + 2\theta_bk_2E \end{aligned}$$

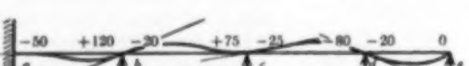
Where M'_{ab}, M'_{ba}, M'_{bc} and M'_{cb} are the original fixed-end moments.

Application for more than one support

In the case of the beam shown in Fig. 1, the value of the final slope of the tangent at b is obtained directly. For a beam continuous over more than one support, we may employ the concepts of joint stiffness and carryover factors and arrive at the final slopes of the tangent at the supports by a simple "step" solution.

The "step" solution can be illustrated by using numerical values for fixed-end moments and relative beam stiffnesses, k, indicated in Fig. 2. The modulus of elasticity is assumed constant and therefore need not appear in the calculations.

Fixed-end moments and k values are written directly on the sketch of the beam. At joint b, the unbalanced restraining moment is $+100$. The unbalanced moments at joints c and d are $+50$ and -100 respectively. Since coefficients for carryover moments are



Fixed-end moment	−50	+120	−20	+75	−25	−80	−20	0
$k = I/L$	$k_1 = 0.5$		$k_2 = 2$		$k_3 = 3$		$k_4 = 8/3$	
$2k$	1		4		6		0	
J		10		20		20		
θ'		−10		−2.5		+5		
ΔM_1			−10	−40	+30	−15		
$\Delta\theta_1$		+1		+0.5		+0.75		
ΔM_2			+2	+4	+4.5	+3		
$\Delta\theta_2$		−0.2		−0.425		−0.150		
ΔM_3			−1.7	−0.8	−0.9	−2.55		
$\Delta\theta_3$		+0.170		+0.085		+0.128		
ΔM_4			+.340	+.680	+.768	+.510		
$\Delta\theta_4$		−0.034		−0.072		−0.025		
Final θ		−9.06		−2.41		+5.70		
Rotating moments	−	−18.1	−72.5	−19.3	−28.9	+68.4	+45.6	−
Carry-over	−9	0	−9.6	−36.2	+34.2	−14.4	0	−
Final moments	−59	+101.9	−102.1	+19.5	−19.7	−26.0	+25.6	0

FIG. 2. Procedure for calculating slopes and moments at supports of continuous beams.

$2k$, these values are shown for the different spans. Joint stiffnesses are calculated for each of the interior joints. At b, $J_b = 4k_1 + 4k_2 = 10$; at c, $J_c + 4k_2 + 4k_3 = 20$; and at d, $J_d = 4k_3 + 3k_4 = 20$.

Now we can proceed with the calculation for the first values of the slopes of the tangents at b, c and d. Releasing each joint successively (just as in Professor Cross's moment distribution), the first values for the slopes are:

$$\theta'_b = \frac{-M'_b}{J_b} = -10;\ \theta'_c = \frac{-50}{20} = -2.5;\ \theta'_d = \frac{-(-100)}{20} = +5.$$

These values are shown in the row labeled θ' in Fig. 2.

The row designated by ΔM_1 shows the first carryover moments induced by the first slopes, θ'. At joint b, for example, the carryover moment from c to b of beam bc is $2k_2\theta'_c = -10$. Similarly, at c of the beam bc, the carryover moment due to θ'_b is $2k_2\theta'_b = -40$. The remaining values for ΔM_1 may be verified by similar calculations.

First increments in the slopes are shown in the row labeled $\Delta\theta_1$. The increment in slope at any joint is equal to the ΔM values at that joint divided by the corresponding joint stiffness, remembering that a negative sign precedes the division. At joint c, for example, $\Delta\theta_1 = \dfrac{-(-40 + 30)}{20} = 0.500$.

The process of calculating new increments in the carryover moments and corresponding increments in the slopes to release these carryover moments is repeated until the desired accuracy is obtained. The calculations shown in Fig. 2 were carried out to yield slide-rule accuracy.

The final slope at a support is the summation of θ', $\Delta\theta_1$, $\Delta\theta_2$, $\Delta\theta_3$ . . . $\Delta\theta_n$. Negative slopes indicate that the tangent has rotated counterclockwise from its initial position; positive slopes indicate a clockwise rotation of the tangent. It must be remembered, however, that these final slopes are relative only and that the actual numerical values of the slopes are equal to the relative values divided by E, the modulus of elasticity.

In view of the widespread use of moment distribution, there is little to commend the use of the inverse operation of obtaining slopes as a first step in the analysis of continuous beams and frames. Yet it is possible, as has been shown, to determine slopes with a facility equal to that provided by moment distribution in determining moments. The direct calculation of slopes does provide an alternative to the solution of simultaneous equations involved in the slope-deflection method.

THE READERS WRITE

AICE opposes bidding on price basis

To the Editor: Your readers may be interested in the following statement, adopted by the Council of the American Institute of Consulting Engineers at its meeting on October 6, 1954:

"The procurement of professional engineering services through competitive bidding on a price basis is a repudiation of the status of engineering as a profession, and the American Institute of Consulting Engineers hereby places itself on record as unalterably opposed to such practice.

"Competitive bidding for engineering services is not in the public interest since it may lead to the employment of the engineer least qualified for the particular work under consideration instead of the best qualified, which should be the objective. The public inevitably suffers from the selection of an unqualified engineer through engineering design which results in uneconomical construction or an unsafe structure.

"The Institute subscribes to the procedure of procuring professional engineering services through negotiation between the principal and the engineer in such a manner that the interests of both parties and the interests of the public, where the public is involved, shall be protected."

T. T. McCrosky, M. ASCE
Secretary, American Institute of Consulting Engineers
New York, N.Y.

Large-displacement deformeters preferred

To the Editor: The equipment described by John P. Cook in "New deformeter developed for structural model analysis," in the August 1954 issue (p. 66) utilizes a micrometer-electronic device for measuring deflections. It is doubtful whether this refinement of deflection measurements applied to rigid frames and arches is worth the effort and investment.

Unless the magnitude of the displacements impressed by the new deformeter is extremely small, an ordinary division scale of 100 parts to the inch, mounted on a reference bar (exactly as with Eney deformeter gages) will prove more than adequate for reading the deflections rapidly and quite accurately. If the new deformeter permits only small displacements and rotations, its design can undoubtedly be improved so that larger movements, say 0.5 in. and 0.2 radians, can be introduced.

Small displacements such as are possible with Beggs deformeters have no advantage over relatively large displacements. In hundreds of experiments with Beggs and Eney deformeters performed by undergraduate students at Manhattan College, it was proved conclusively that Eney deformeters are at least as accurate as the far more complicated Beggs apparatus. Moreover, the operation of large-displacement gages is more rapid and more reliable, and permits a visual qualitative study of the behavior of statically indeterminate structures. For the undergraduate student, this is a distinct advantage.

It would appear from the author's description of the way the deflections are observed that the value of the redundant is a function of the magnitude of a single deflection measured in the direction of the assumed load at the load point. Actually, two deflection readings, corresponding to two equal and opposite displacements effected by the redundant, are required in order to eliminate the effect of the geometric (non-elastic) distortion of the model. The correct value of the redundant is a function of the sum of the two deflections. Unless this is done, relatively large errors will be introduced.

It is not clear whether or not it is possible to determine the thrust at the left support caused by a horizontal load acting at the point of the left column where the micrometer screw is mounted. Unless the induced vertical displacement of the left support is less than the radius of the micrometer screw, and the latter is centered on the target needle when the model is in neutral position, a contact between the screw and the needle cannot be established.

Otakar Ondra, A.M. ASCE
Assoc. Prof. of Civil Engineering
Manhattan College
New York, N.Y.

Earthquake design formula

To the Editor: In Roy E. Guard's article, "Reinforced Brick Masonry Chosen for California V.A. Hospital," in the October issue (p. 54), there is an apparent error and a misdirected credit.

Mr. Guard credits the Uniform Code of the Pacific Coast Building Officials Conference for the earthquake design formula, although this formula originated in the 1952 revision of the Los Angeles City Building Code, where it still appears. The Pacific Coast Building Officials Conference adopted it several years after it had been required in Los Angeles. Since Mr. Guard credits the Los Angeles City Code for working stresses used in brickwork, it would seem reasonable to follow the same procedure with reference to the earthquake design formula.

As quoted in the article, the formula would yield a design lateral force of nearly five times gravity for the three-story structure illustrated. The formula should read, $C = \dfrac{60}{N + 4.5}$, rather than

"$(0.60/N) + 4^1/_2$."

C. J. Derrick, M. ASCE
Consulting Engineer
Los Angeles, Calif.

Graphical solutions for preliminary dam sections

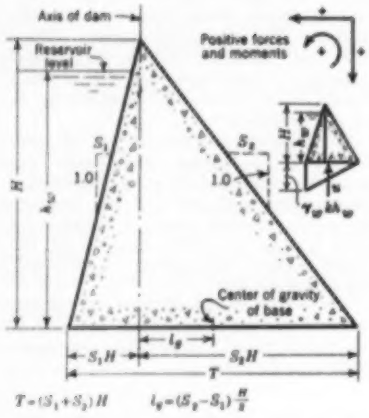


FIG. 1. Triangular gravity dam section indicates notation.

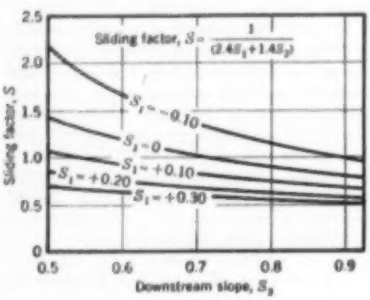


FIG. 2. Values of sliding factor are given by curves. See Fig. 5 for loading assumptions.

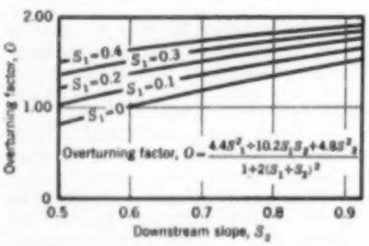


FIG. 3. Values of overturning factor, O, are given for various values of S_1 and S_2.

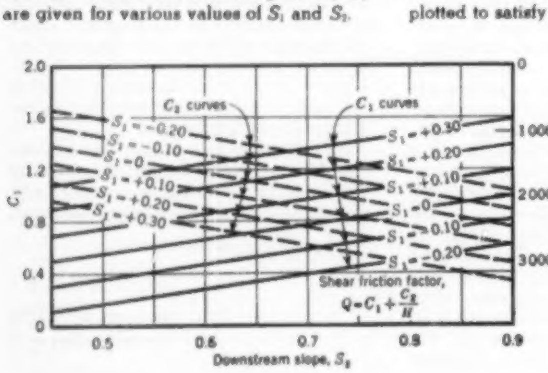


FIG. 4. Values of C and C_2 for triangular dam section are found by graphics.

To the Editor: The method of selecting preliminary sections for concrete gravity dams, as described by David D. Congleton in his article, "Preliminary Sections Determined for Concrete Gravity Dams" (June 1954 issue, p. 68), considers only the factors of safety against sliding and overturning. It is however possible to include other criteria, such as the shear-friction factor, and develop comprehensive equations to quickly determine preliminary sections of gravity dams. In the writer's article, "Selection of a Preliminary Triangular Section for Gravity Dams" (*Civil Engineering and Public Works Review*, London, February 1951), design criteria are given based on the following factors: sliding factor, overturning factor, shear-friction factor, and Levy's criterion (that is, the vertical stress at the upstream face must be greater than the external water pressure at that point).

Equations were developed for these factors in terms of upstream and downstream slopes as well as other variables. Negative upstream slopes were also considered as a matter of academic interest. Some of the equations are long and cumbersome. To simplify the procedure, graphical solutions were prepared for the factors for an assumed set of loading conditions, which were considered reasonable for preliminary designs.

Figures 1 to 5 give an idea of the ease with which the slopes of a preliminary section can be selected. Most of the notation, and the sign conventions for forces and moments, are shown in Fig. 1. Figures 2 and 3 give values of sliding and overturning factors for combinations of upstream and downstream slopes. Two constants, C_1 and C_2, are obtained from Fig. 4, to compute the shear friction factor Q, for the given height of a dam. The relationship between the upstream and downstream slopes to satisfy Levy's criterion is presented in Fig. 5. It is seen that the designer has the choice of adopting a triangular section satisfying either all or only some of the criteria he may consider the most significant.

In another article, "Selection of an Ideal Section for Gravity Dams" (*Civil Engineering and Public Works Review*, London, December 1951), the writer has also attempted the graphical solution of preliminary gravity dam sections with broken upstream slope and uniform downstream slope. The sliding factor, shear friction factor, and volumetric contents were considered the deciding criteria. With this set of diagrams, it is possible to investigate alternative sections in a matter of minutes, provided the loading conditions assumed for these diagrams are considered reasonable for a preliminary investigation.

Gurmukh S. Sarkaria, J.M. ASCE
Senior Design Engineer
Bhakra Dam Designs Directorate

New Delhi, India

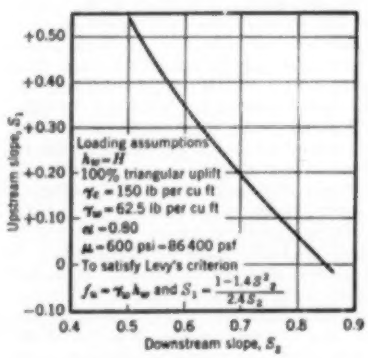


FIG. 5. Relation between S_1 and S_2 is plotted to satisfy Levy's criterion.

Author comments

To the Editor: Although Mr. Sarkaria has used a different approach from mine in determining the preliminary section, it is noted that his equation for the sliding factor is identical with my Eq. 3. Both of us are searching for the economic relation between the upstream and downstream slopes of the dam which will satisfy stability.

Mr. Sarkaria's charts would be very useful for designers using his criteria of design, which are considered satisfactory by many designers. My equations were developed to permit the designer more latitude on uplift assumptions, and the economic section can be determined immediately from Eq. 1. I believe an experienced designer would arrive at approximately the same section by Mr. Sarkaria's method as he would by my method.

It certainly was interesting to find someone so far away with thoughts so similar to mine on this subject.

David D. Congleton, M. ASCE
U.S. Army Engineers
Office of the District Engineer

Baltimore, Md.

San Diego Convention

Sponsored by the San Diego Section

U. S. Grant Hotel — San Diego, Calif. — February 9–11, 1955

REGISTRATION

U. S. Grant Hotel Lobby

Monday, Feb. 7, 9:00–5:00
Tuesday, Feb. 8, 9:00–7:00
Wednesday, Feb. 9, 8:00–5:00
Thursday, Feb. 10, 9:00–5:00
Friday, Feb. 11, 9:00–12:00

Registration fee, except for ladies and students, $3.00.

ADVANCE ATTENDANCE INFORMATION

To assure adequate preparation to make your attendance at the San Diego Convention most satisfactory, the Committee requests your assistance. It is most helpful to have guidance in the number of persons to be expected for the various functions. Will you please use the coupon on page 106, which is to be sent to R. S. Holmgren, Registration Chairman, 235 Broadway, San Diego 1, Calif.

There is no obligation attached to your use of this coupon. It can be very helpful, with your cooperation.

AUTHORS' BREAKFASTS

Regency Room

7:45 a.m., Wednesday, Thursday and Friday

Briefing sessions for speakers, discussers and program officials by invitation.

Presiding: Jean L. Vincenz, Chairman, Technical Program.

LOCAL SECTIONS CONFERENCE

Monday and Tuesday, Feb. 7–8

9:30 a.m. — **Riviera Room**

Representatives of Local Sections of ASCE in the area about the convention location will convene for discussion of expanding activities of the Society at local level. The conference, which is primarily for invited delegates of selected Sections, will be open to all who may be interested in the activities and operational details of ASCE Local Sections.

NO-HOST COCKTAILS AND BUFFET DINNER

Tuesday, Feb. 8

7:00 p.m. — **Kona Kai Club**

Dinner and cocktails will be at the fabulous Kona Kai Club. Located at the south end of Shelter Island, it lies between the yacht harbor on the west and the entrance to the main San Diego harbor on the east. Kona Kai has one of the most unusual locations in the world.

Per plate $3.50

WEDNESDAY MORNING FEB. 9

Welcome Session

9:30 a.m. — **California Theater**

Presiding: Robert K. Fogg, General Chairman, San Diego Convention Committee

9:30 **Welcome by San Diego Section**
W. J. Bobisch, President, San Diego Section.

9:35 **Welcome by City and County of San Diego**
Hon. John Butler, Mayor, City of San Diego.
Hon. James A. Robbins, Chairman, Board of Supervisors, County of San Diego.

9:50 **Response and Address**
William R. Glidden, President, ASCE.

10:20 **Award of Daniel W. Mead Prize**
To Alfred E. Waters, J.M. ASCE.

General Session

10:40 a.m. — **California Theater**

Sponsored by Committee on Conditions of Practice

Presiding: Mason G. Lockwood, Zone IV, Vice President, ASCE

10:40 **Engineering Education in Relation to the Profession**
Harvey O. Banks, A.M. ASCE, Asst. State Engineer, Calif. Div. of Water Resources, and Member of ASCE Special Joint Task Committee on Engineering Education.

11:10 **What is the Basis of the Society's 1955 Salary Survey?**
Robert J. Ellison, A.M. ASCE, Consulting Engineer, St. Paul, Minn., and Chairman, ASCE Committee on Salaries.

11:45 **Adjournment for Membership Luncheon in Balboa Park Club**

MEMBERSHIP LUNCHEON

Wednesday, Feb. 9

12:30 p.m. — **Balboa Park Club**

Speaker: Maj. Gen. Samuel D. Sturgis, Jr., M. ASCE, Chief, Corps of Engineers.

All members, their ladies, students, guests and friends of ASCE are cordially invited.

Per plate $3.00. Students $2.50.

WEDNESDAY AFTERNOON FEB. 9

The following Divisions will hold technical sessions Wednesday afternoon in Balboa Park: Waterways, Hydraulics, Sanitary Engineering, and Surveying and Mapping. In addition a session on Conditions of Practice will be held.

Conditions of Practice

2:15 p.m. — **Balboa Park Club**

Presiding: Mason G. Lockwood, Zone IV, Vice President, ASCE

2:15 **Progress of Unionization and Collective Bargaining Among Engineering Employees**
Sterling S. Green, M. ASCE, Asst. Field Engineer, Dept. of Water and Power, City of Los Angeles, and Member, ASCE Committee on Employment Conditions.

2:45 **Discussion**

3:00 **Panel Discussion**
Subject: Unions, Unity, or Utopia
Moderator: Mason G. Lock-

wood, Zone IV, Vice President ASCE, and Chairman of ASCE Conditions of Practice Committee.

Panel Members

Harold A. Halldin, J.M. ASCE, Asst. City Engineer, City of Alhambra, Calif.

Dewain R. Butler, J.M. ASCE, President, Integrated Constructors and Engineers, Inc., Los Angeles, Calif.

Hodge Gaines, J.M. ASCE, Sales Manager, Norris Steel, Los Angeles, Calif.

Hydraulics Division

2:15 p.m. Conference Bldg., Balboa Park

Presiding: T. J. Corwin, Jr., Chairman, Executive Committee, Hydraulics Division

2:15 **Water Requirements in California**
William L. Berry, A.M. ASCE, Principal Hydraulic Engineer, Division of Water Resources, State of Calif., Sacramento.

2:50 **Water Problems of the Tia Juana River, San Diego, Calif.**
John M. Page, A.M. ASCE, Senior Hydraulic Engineer, Division of Water Resources, State of Calif., Sacramento.

3:20 **Measurement of Quantity and Salinity of Outflow from Sacramento-San Joaquin Delta**
Irvin M. Ingerson, A.M. ASCE, Principal Hydraulic Engineer, Dept. of Public Works, State of Calif., Sacramento.

4:00 **Ground Water Phenomena Related to Basin Recharge**
Paul Baumann, M. ASCE, Asst. Chief Engineer, Los Angeles Flood Control District, Los Angeles, Calif.

4:30 **Discussion**
Harlowe M. Stafford, M. ASCE, Engineer in Charge, Water Resources Div., Surface Water Branch, U.S. Geological Survey, Sacramento.

Sanitary Engineering Division

2:15 p.m. Puppet Theater, Balboa Park

Presiding: R. R. Kennedy, Member, Executive Committee, Sanitary Engineering Division

2:15 **Radioactive Water Decontamination**
Conrad P. Straub, A.M. ASCE, Senior Engineer, USPHS, Oak Ridge National Laboratory, Oak Ridge, Tenn.

3:15 **Recharging Underground Basins**
Los Angeles County Flood Control District.

Surveying and Mapping Division

2:15 p.m. Conference Bldg., Balboa Park

2:15 **Basic Principles and Characteristics of Photogrammetry**
J. R. Newville, A.M. ASCE, Engineering Service Corp., Los Angeles, Calif.

3:00 **Progress in Topographic Mapping**
Robert O. Davis, A.M. ASCE, Region Engineer, Rocky Mountain Div., U.S. Geological Survey.

3:45 **Land Surveys**
William C. Wattles, Registered Civil Engineer and Licensed Land Surveyor, Glendale, Calif.

Waterways Division

2:15 p.m. Recital Hall, Balboa Park

Presiding: Rufus W. Putnam, Member, Committee on Diversions, Waterways Division

2:15 **Planning Criteria for Largest Single Modern Shipping Terminal for Port of San Diego**
J. E. Liebman, Chief Engineer, Port of San Diego.

3:00 **Problems of Planning, Design, Maintenance and Regulation of Flood Control Works in Lower Reaches of Los Angeles River**
James G. Jobes, A.M. ASCE, Deputy Chief, Engineering Div., Los Angeles Dist., Corps of Engineers, U.S. Army.

3:45 **Protection of Properties in the Subsidence Areas in and Near Long Beach, Calif.**
Robert R. Shoemaker, M. ASCE, Chief Harbor Engineer, Port of Long Beach, Calif.

THURSDAY MORNING

FEB. 10

Air Transport Division

9:30 a.m. KSFD Radio Station

Presiding: Dewey S. Wright, Member, Executive Committee, Air Transport Division

9:30 **Effect of Traffic Distribution on Runway Pavement Cross Section**
Robert Horonjeff, A.M. ASCE, Lecturer and Research Engineer; and John Hugh Jones, A.M. ASCE, Asst. Prof. of Civil Engineering and Asst. Research Engineer; Inst. of Transportation and Traffic Engineering, Univ. of California, Berkeley.

10:45 **Future Development of Metropolitan Oakland International Airport**
Joseph G. Bastow, M. ASCE, Asst. Port Manager and Asst. Chief Engineer, Port of Oakland.

City Planning and Waterways Divisions—Joint Meeting

9:30 a.m. Venetian Room

Presiding: Huber E. Smutz, Member, Executive Committee, City Planning Division

Planning and Developing Small-Craft and Pleasure Harbors

9:30 **The Mission Bay Development in San Diego**
Glenn Rick, Director of Planning, San Diego.

10:00 **Federal Participation in Construction of Small-Craft Harbors**
Lyman A. Markel, A.M. ASCE, Rivers and Harbors Planning Section, U.S. Corps of Engineers, Los Angeles, Calif.

10:30 **Problems Encountered in Designing the Most Modern Marina for Alamitos Bay, Long Beach, Calif.**
George F. Nicholson, M. ASCE, Consulting Engineer, Long Beach, Calif.

11:00 **The Development of Newport Harbor and Planned Development of Upper Newport Bay, Calif.**
R. L. Patterson, A.M. ASCE, Consulting Engineer, Newport Beach, Calif.

11:30 **Discussion**

Construction Division

9:30 a.m. Concord Room

Presiding: John P. Hart, Member, Executive Committee, Construction Division

9:30 **Steel Erection on the Richmond-San Rafael Bridge**
Philip Murphy, Judson Pacific Murphy Corp.

10:15 **Construction of Santa Ana Outfall Sewer Into Pacific Ocean**
Robert Helen, Healy-Tibbets Construction Co.

11:00 **Prestressed Construction in Pacific**

Southwest, with Emphasis on Construction Problems

J. R. LIBBY, Freyssinet Company, Inc.

Irrigation and Drainage Division

9:30 a.m. Riviera Room

Presiding: Harry F. Blaney, Member, Executive Committee, Irrigation and Drainage Division

9:30 **Feather River Project—Stressing Tunnel Versus High Lift**

A. D. EDMONSTON, M. ASCE, State Engineer, Calif. Div. of Water Resources, Sacramento.

10:00 **Discussion**

10:15 **Design Problems of the San Diego Aqueduct**

ROBERT E. SAILER, M. ASCE, Engineer, U.S. Bureau of Reclamation, Denver, Colo.

10:45 **Discussion**

11:00 **Construction Problems—Tecolote Tunnel**

E. R. CROCKER, Project Manager, U.S. Bureau of Reclamation, Goleta, Calif.

11:30 **Discussion**

Sanitary Engineering Division

9:30 a.m. Room 845

Presiding: R. R. Kennedy, Member, Executive Committee, Sanitary Engineering Division

9:30 **Auckland, New Zealand, Sewage Disposal Problems**

A M RAWN, M. ASCE, Chief Engineer and General Manager, County Sanitation Districts of Los Angeles County.

10:15 **Physical and Oceanographic Factors in Sewage Disposal**

D. L. INMAN, Asst. Prof. of Marine Geology, Scripps Inst. of Oceanography, Univ. of Calif.; and J. F. T. SAUR, Oceanographer, Naval Electronics Laboratory, San Diego.

11:00 **Digestion of Industrial Wastes, Including Recent Work on Citrus Wastes**

A. M. BUSWELL, Chief, State Water Survey Division, Illinois.

Soil Mechanics and Foundations Division

9:30 a.m. California Theater

Presiding: W. W. Moore, M. ASCE; Dames and Moore, Civil Engineers, San Francisco, Calif.

9:30 **Shear Characteristics of Pervious Gravelly Soils as Determined by Triaxial Tests**

W. H. HOLTZ, M. ASCE, Head; and H. J. GIBBS, J.M. ASCE, Engineer; Earth Materials Laboratory, U.S. Bureau of Reclamation, Denver, Colo.

10:00 **Application of Large Shear Tests to Design of Earth Structures**

J. G. PATRICK, A.M. ASCE, Chief, Geology, Soils and Materials Branch, North Pacific Div., Corps of Engineers, Portland, Ore.

10:30 **Triaxial Shear Testing Developments Within South Pacific Division, Corps of Engineers**

E. B. HALL, Head, Soils Section, South Pacific Div., Corps of Engineers, Sausalito, Calif.

11:00 **Discussion**

S. D. WILSON, M. ASCE, Shannon and Wilson, Soil Mechanics and Foundation Engineers, Seattle, Wash.

11:15 **Discussion**

D. W. TAYLOR, A.M. ASCE, Assoc. Prof., Soil Mechanics, Mass. Inst. of Technology, Cambridge.

FACULTY ADVISERS CONFERENCE

Thursday, Feb. 10

9:00 a.m. U. S. Grant Hotel Regency Room

Faculty Advisers from ASCE Student Chapters in the West will convene for a one-day discussion of Student Chapter problems.

This conference, which is primarily for invited Advisers, will be open to all Contact and Junior Contact Members of Chapters and others interested in the activities and operational details of ASCE Student Chapters.

PACIFIC SOUTHWEST CONFERENCE LUNCHEON

Thursday, Feb. 10

12:15 p.m. Venetian Room U.S. Grant Hotel

Following luncheon, there will be the annual business session and a discussion of topics of interest to the Pacific Southwest Conference.

Per plate $3.00. Students $2.50.

THURSDAY AFTERNOON FEB. 10

Air Transport Division

2:00 p.m. KSFD Radio Station

2:00 **Field Control of Bituminous Paving Mixtures for Navy Airfield Pavements**

LEO KENNETH BERRY, Jr., J.M. ASCE, General Engineer, Paving, Inspection and Testing Div., Public Works Office, Twelfth Naval District.

3:00 **New Terminal for San Francisco International Airport**

JULIAN L. BARDOFF, A.M. ASCE, Engineer, Hetch Hetchy Water Supply, Power and Utilities Engineering Bureau, San Francisco, Calif.

Construction Division

2:00 p.m. Concord Room

Presiding: Charles M. Davis, Member, Executive Committee, Construction Division

2:00 **Construction of 34-In. Gas Transmission Line for Pacific Gas & Electric Co.**

STEVE BECHTEL, JR., The Bechtel Corp., San Francisco; and MR. REYNOLDS, Pacific Gas & Electric Co., San Francisco.

City Planning Division

2:00 p.m. Venetian Room

Presiding: Huber E. Smutz, Member, Executive Committee, City Planning Division

How May the Planning, Financing and Construction of Vehicular and Mass Transit Systems in the Modern Metropolitan Area Be Integrated?

2:00 **The General Problem**

HARMER DAVIS, A.M. ASCE, Director, Inst. of Transportation and Traffic Engineering, Univ. of Calif., Berkeley.

2:30 **Does Monorail or Other Rail Transit Offer a Possible Solution?**

GEORGE W. BURPEE, M. ASCE, Coverdale & Colpitts, Consulting Engineers, New York, N.Y.

3:00 **The San Francisco Bay Area Mass Transit Study**

RUSH F. ZIEGENFELDER, M. ASCE, partner, Parsons, Brinckerhoff, Hall and Macdonald, New York, N.Y.

3:30 **Are Rapid Transit Busses on Freeways the Answer?**

STANLEY LANHAM, A.M. ASCE, Vice President, Los Angeles Transit Lines.

4:00 Is Subsidy Necessary for Adequate Mass Transit?
CHARLES E. DE LEUW, M. ASCE, President, De Leuw-Cather & Co., Chicago, Ill.

Irrigation and Drainage Division

2:00 p.m. — Riviera Room

Presiding: Harry F. Blaney, Member, Executive Committee, Irrigation and Drainage Division

2:00 Colorado River Storage Projects—Five Upper Basin States
E. O. LARSEN, Regional Director, U.S. Bureau of Reclamation, Salt Lake City, Utah

2:30 Discussion

2:45 Canal Seepage
CARL ROHWER, M. ASCE; and A. R. ROBINSON, J.M. ASCE; Irrigation Engineers, Soil and Water Conservation Research Branch, Agricultural Research Service, U.S. Dept. of Agriculture, Fort Collins, Colo.

3:15 Discussion

3:30 Economic Utilization of Ground Water and Surface Reservoirs
FRANK B. CLENDENEN, J.M. ASCE, Div. of Civil Engineering, Univ. of Calif., Berkeley

4:00 Discussion

Sanitary Engineering Division

2:00 p.m. — Room 845

Presiding: R. R. Kennedy, Member, Executive Committee, Sanitary Engineering Division

2:00 Sanitary Engineering Aspects of WHO Program
FRANK M. STEAD, M. ASCE, Chief, Div. of Environmental Sanitation, Calif. Dept. of Public Health

2:45 Refuse Disposal—a Panel Discussion
HAROLD B. GOTAAS, M. ASCE, Prof., Div. of Sanitary Engineering, Univ. of Calif., Berkeley; RICHARD R. KENNEDY, M. ASCE, Partner, Clyde C. Kennedy, San Francisco; JOHN L. PARTIN, A.M. ASCE, Asst. Div. Engineer, Industrial Waste Div., County of Los Angeles; and WARREN A. SCHNEIDER, A.M. ASCE, Director, Bureau of Sanitation, Dept. of Public Works, City of Los Angeles

3:45 Setting Water Quality Criteria in the California Water Pollution Control Program
VINTON W. BACON, A.M. ASCE, Executive Officer, State of Calif. Water Pollution Control Board

THE MEXICAN HAT DANCE

Thursday, Feb. 10

Balboa Park Club

6:30 Assembly and cocktails
Music by the Strolling Troubadours

7:30 Dinner in the ballroom

8:30 Dancing to music by Les Brown and his Band of Renown
Dress, semi-formal

Per person $7.50. Students $4.50

FRIDAY MORNING FEB. 11

Highway Division

9:30 a.m. — Calif. Theater

Presiding: Ralph B. Luckenbach, Member, Committee on Session Programs, Highway Division

9:30 Design and Performance of Rigid Culverts under High Overfills
R. ROBINSON ROWE, M. ASCE, Supervisory Bridge Engineer, State Div. of Highways, Sacramento, Calif.

10:15 Metropolitan Freeway System in Los Angeles Area
Planning and Operation, illustrated with colored slides.
PAUL O. HARDING, Asst. State Highway Engineer, Calif. Div. of Highways

Structural Division

9:30 a.m. — Venetian Room

Presiding: John Case, Chairman, Los Angeles Section Structural Group

9:30 Horizontal Load Test of a Timber Building
J. MORLEY ENGLISH, Assoc. Prof. of Engineering, Univ. of Calif., Los Angeles; C. FRANKLIN KNOWLTON, Civil Engineer, Los Angeles

10:15 Developments in Prestressed Concrete in the San Diego Area
ROBERT C. DORLAND, A.M. ASCE, Chief Engineer, Southwest Structural Concrete Corp., San Diego, Calif.

11:00 The Naval Construction Program in the San Diego Area
KENNETH A. GODWIN, Capt. U.S.N., Public Works Officer, 11th Naval District

11:15 New Structural Techniques Cut 11th Naval District Construction Costs
WILLIAM J. BOBISCH, M. ASCE, Chief of Design Div., Public Works Dept., 11th Naval District

Engineering Mechanics Division

9:30 a.m. — Concord Room

Presiding: Harry A. Williams, M. ASCE, Prof. of Civil Engineering, Stanford University

9:30 Analysis of Observed High-Intensity Structural Vibrations During Earthquakes
GEORGE W. HOUSNER, A.M. ASCE, Asst. Prof. of Applied Mechanics, Calif. Inst. of Technology, Pasadena

10:00 Correlation of Observed and Computed Structural Vibrations Produced by Ground Motion
DONALD E. HUDSON, Professor, Mechanical Engineering, Calif. Inst. of Technology, Pasadena

10:30 The Energy Criterion in the Elastic Stability Problem
EGOR P. POPOV, A.M. ASCE, Assoc. Prof. of Civil Engineering, Univ. of California, Berkeley

11:00 Analysis of Statically Indeterminate Frameworks by Method of Unknown Joint Displacements
HAROLD C. MARTIN, Prof. of Aeronautical Engineering, Univ. of Washington, Seattle

Soil Mechanics and Foundations Division

9:30 a.m. — Riviera Room

Experiences with Earth-Fill Compaction Equipment

Presiding: S. D. Wilson, M. ASCE, Member, Executive Committee, Soil Mechanics and Foundation Division

9:30 Compacting Earth Dams with Heavy Tamping Rollers
J. W. HILF, A.M. ASCE, Civil Engineer, Bureau of Reclamation, Denver, Colo.

10:00 Compaction by Pneumatic-Tired Rollers
O. J. PORTER, M. ASCE; K. H. O'BRIEN, A.M. ASCE; Porter, Urquhart & Beavin, Engineers, Los Angeles, Calif.

10:30 Rubber-Tired versus Sheepsfoot Rollers
W. J. TURNBULL, Chairman, Executive Committee, Soil Mechanics and Foundations Division; Chief, Soils Division, U.S. Waterways Experiment Station, Vicksburg, Miss.
C. R. FOSTER, A.M. ASCE, Asst. Chief, Flexible Pavements Branch, U.S. Waterways Experiment Station, Vicksburg, Miss.

11:00 Discussion
R. R. Proctor, M. ASCE, Field Engineer, Dept. of Water and Power, City of Los Angeles, Calif.

Power Division

9:30 Room 845

9:30 **Morro Bay Steam Plant**

G. L. Coltrin, A.M. ASCE, Senior Civil Engineer, Pacific Gas and Electric Co.; J. George Thon, M. ASCE, Supervising Structural Engineer, Bechtel Corporation, San Francisco.

10:00 **Discussion**

10:15 **Owens Gorge Project of Los Angeles Dept. of Water and Power**

Samuel B. Morris, M. ASCE, General Manager and Chief Engineer, Los Angeles Dept. of Water and Power.

10:45 **Discussion**

11:00 **Vermillion Valley Project**

Ralph W. Spencer, M. ASCE, Manager of Engineering Dept., Southern Calif. Edison Co., Los Angeles, Calif.

11:30 **Discussion**

STUDENT CHAPTER CONFERENCE

Friday, Feb. 11

9:30 a.m. KSFD Radio Station

AWARD LUNCHEON

Friday, Feb. 11

12:15 p.m. Venetian Room, U.S. Grant Hotel

Speaker: Rear Admiral John R. Perry, CEC, USN, Chief, Bureau of Yards and Docks.

Presentation of awards to winners of the student speakers' contest and introduction of each participating student.

Per plate $3.00. Students $2.50.

FRIDAY AFTERNOON

FEB. 11

Highway Division

2:00 p.m. Concord Room

Presiding: Harmer E. Davis, Member, Executive Committee, Highway Division

2:00 **Development of a Standard Manual for Highway Design as Used in the State of California**

J. C. Young, M. ASCE, Highway Design Engineer, Calif. Div. of Highways, Sacramento.

2:45 **Soil Action along Friction Piles**

Prof. H. B. Seed; L. Reese; Dept. of Engineering, Univ. of Calif., Berkeley.

3:30 **Paper by Institute of Transportation and Traffic Engineering, University of California**

Power Division

2:00 p.m. Room 845

2:00 **Selection of Installed Capacity at Hydroelectric Power Plants**

Lesher S. Wing, Regional Engineer; and Robert H. Griffin, A.M. ASCE, Engineer; Federal Power Commission, San Francisco, Calif.

2:50 **Discussion**

3:00 **McNary Dam—Project Design from Technical Considerations**

G. C. Richardson, A.M. ASCE; Chief, Hydraulic Design Section; H. M. Rigler, Chief, Structural Design Section; and H. L. Drake, A.M. ASCE, Chief, Foundations and Materials Branch; Corps of Engineers, Walla Walla, Wash.

R. A. Schuknecht, Chief of Hydroelectric Design Branch, North Pacific Division, Corps of Engineers, Portland, Oreg.

3:50 **Discussion**

Soil Mechanics and Foundations Division

2:00 p.m. Riviera Room

Presiding: F. J. Converse, M. ASCE, Prof. of Soil Mechanics, Calif. Institute of Technology, Pasadena

2:00 **Experiences with the Foundation at Santa Felicia Dam**

Julian Hinds, M. ASCE, General Manager and Chief Engineer; and N. S. Long, A.M. ASCE, Resident Engineer, Santa Felicia Dam; United Water Conservation Dist., Santa Paula, Calif.

2:30 **Construction Moisture Control by Use of the Penetration Needle**

R. R. Proctor, M. ASCE, Field Engineer, Dept. of Water and Power, City of Los Angeles, Calif.

3:00 **Field Study of a Cellular Sheetpile Bulkhead**

C. M. Duke, A.M. ASCE, Assoc. Prof. of Engineering, Univ. of Calif., Los Angeles.

3:30 **Open discussion**

2:45 **Building Against Earthquakes**

R. W. Binder, A.M. ASCE, Chief Engineer, Bethlehem Pacific Steel Corp., Los Angeles.

3:40 **Recommended Procedures for Earthquake Resistive Structural Design**

Donald F. Moran, A.M. ASCE, Structural Engineer, Pacific Fire Rating Bureau, Los Angeles.

Structural Division

2:00 p.m. Venetian Room

Presiding: George E. Brandow, Structural Engineer, Los Angeles, and Member, Executive Committee, Structural Division

2:00 **Seismology and Earthquake Damage**

Hugo Benioff, Prof. of Seismology, Calif. Inst. of Technology, Pasadena.

A NIGHT IN OLD MEXICO

Friday, Feb. 11

Tijuana, B.C., Mexico

Chartered busses leave U.S. Grant Hotel at 6:30 p.m. for an enjoyable evening in old Mexico. A guide will meet the party at the border and take the group to dinner at a leading restaurant, thence to Jai Alai, the world's fastest game. Busses will leave Tijuana at 11:30, arriving back at the hotel about 12:30.

Price, $7.00 per person, including transportation, Jai Alai, cocktails, and dinner.

Foreign-born persons are cautioned to take with them proof of citizenship or a visa.

SATURDAY MORNING

FEB. 12

Field Trips

9:00 **Encina Steam Plant**

San Diego Gas & Electric Co., Carlsbad, Calif., located 34 miles north of San Diego. Unit 1, rated at 100,000 kw, was placed in operation last November. Unit 2 is now in the initial stages of construction.

Busses will leave the U.S. Grant Hotel and return about 1:00 p.m.

9:30 U.S. Naval Aircraft Carrier

Probably one of the large Essex-class carriers.

Busses leave the U.S. Grant Hotel and go by ferry to the North Island Naval Air Station, returning about 12:30. No cameras permitted.

10:00 Loading-to-failure of a 66-in. prestressed, tapered, concrete girder

Southwest Structural Concrete Corp. casting yard at the foot of Texas Street, Mission Valley.

ROBERT C. DORLAND, A.M. ASCE, Chief Engineer, will demonstrate a unique clip which permits the prestressing of several units at a time.

Busses leave U.S. Grant Hotel and return at noon.

LADIES PROGRAM HIGHLIGHTS

Monday, Feb. 7

Luncheon in La Jolla, the Jewel of the Pacific. Then a visit to this community's smart and unique shopping center where charming and attractive stores offer many specialty items not obtainable elsewhere.

A visit also to the University of California's La Jolla campus, where, at the Scripps Institution of Oceanography, world famous scientists study and carry on research projects. The large modern aquarium contains a wide variety of native sea life.

Tuesday, Feb. 8

Dinner and cocktails at the Kona Kai Club.

Wednesday, Feb. 9

Following the Membership Luncheon at the Balboa Park Club, the ladies will be treated to a visit to San Diego's world famous zoological gardens. The chief charm of the San Diego Zoo lies in its natural out-of-door settings. Animals are shown in family groups and in open barless grottoes. The entire zoo can be seen from special busses.

Thursday, Feb. 10

Lunch at world renowned Hotel del Coronado where, with its old-time charm, distinguished guests have been served for over half a century. Following lunch, ladies will be picked up at the Hotel del Coronado pier and taken on an excursion on San Diego Bay.

Dinner-dance in the evening (semi-formal) at the beautiful Balboa Park Club, where dancing and entertainment will be provided by Les Brown and his Band of Renown.

Friday, Feb. 11

Daytime, open for your pleasure. In the evening, dinner and Jai Alai in Tijuana, Mexico.

WHAT TO WEAR—For daytime, wear a wool suit, or winter dress and lightweight coat. Lightweight fall or winter apparel will be suitable. Casual wear is the usual thing in Southern California.

LADIES HOSPITALITY ROOM

Room 735 **Daily**

The Hospitality Room will be the gathering place of all ladies attending the Convention. On Wednesday, Thursday and Friday mornings, from 9 to 10, coffee will be served. San Diego hostesses will be in attendance to assist in the enjoyment of the Convention by the visiting ladies.

POST CONVENTION TOUR TO HAWAII

Tuesday, Feb. 15

An all-day meeting of the Hawaii Section will be held in Honolulu on February 15. Details of this meeting, together with information about hotel and travel facilities, will be given in the January issue, or may be obtained from the Hawaii Section, Mr. Arthur N. L. Chiu, Publicity Chairman, University of Hawaii, Dept. of Civil Engineering, Honolulu 14, Hawaii.

INFORMATION AND REGISTRATION

Information and registration facilities will be maintained in the lobby of U. S. Grant Hotel throughout the days of the Convention. Mail and messages will be held for members at the information desk.

GOLFERS

The San Diego Convention Committee will make arrangements, on request, for golfing on the world famous course at Rancho Santa Fe or at the Caliente Course in Tijuana. Clubs may be rented at either place.

HOTEL ACCOMMODATIONS

Headquarters for the San Diego Convention will be the U. S. Grant Hotel, 326 Broadway, near Balboa Park and San Diego Bay. Special arrangements have been made to house many Convention guests at this headquarters hotel, up to capacity, in the order that reservation requests are received.

Send your request as early as possible to assure the space you prefer. For your convenience, a special request form is provided on page 106 of this issue.

Should you prefer accommodations at another hotel or motel, please give details in the space provided on that coupon. Dormitory accommodations are available for students at the U. S. Grant.

PRESS ROOM

Crest Room

For the convenience of the technical press, newspapers and radio, a press room will be open throughout the days of the Convention.

San Diego Convention Committees

Robert K. Fogg, *General Chairman*
M. J. Shelton, *Director, District 11*
P. W. Helsley, *Entertainment*
G. R. Saunders, *Excursions*
C. A. Smith, *Finance*
T. G. Atkinson, *Hotel*
Mrs. R. K. Fogg, *Ladies Activities*
Mrs. W. J. Bobisch
Mrs. R. S. Holmgren
Mrs. E. A. Lawrence
Mrs. M. J. Shelton
E. A. Lawrence, *Publicity*
L. E. Deewall, *Reception*
R. S. Holmgren, *Registration*
L. L. Flor, *Student Activities*
J. L. Vincenz, *Technical Program*
I. L. Nolan, *Treasurer*

Student Chapter Hosts

San Diego State College
University of Southern California
California Institute of Technology

SOCIETY NEWS

MERRY CHRISTMAS ★ HAPPY NEW YEAR

San Diego Convention Offers Notable Program in Winter Vacation Setting

This winter when frost and snow take over in most parts of the United States, delegates to the Society's San Diego Convention, to be held February 2-5, will find themselves basking in sun-baked Southern California. The Convention headquarters in one of the city's finest downtown hotels, the U. S. Grant, will be within an hour's drive of everything from surf riding along the miles of beach that rim the harbor to skiing in the snow-covered mountains of Laguna and Cuyamaca. Borrowing the theme, "There's more to do . . . plus Old Mexico, too," General Convention Chairman Robert K. Fogg and his staff have arranged a number of excursions to supplement the diversified and interesting technical program. (The full Convention program of technical and social events is listed elsewhere in this issue.)

Many Engineering Projects in Area

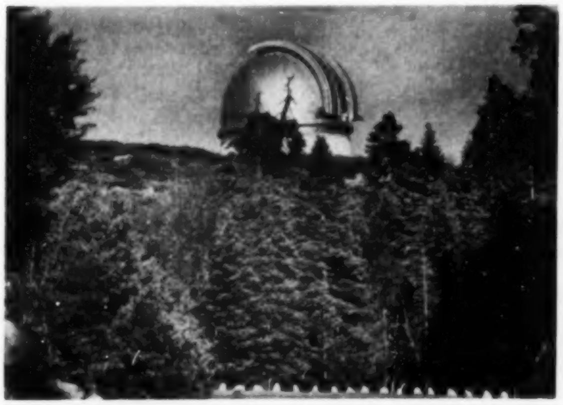
Of special interest to the visiting engineers will be some of the nationally renowned structures in the county, such as the Palomar Observatory and its 200-in. Hale telescope mirror. Another feature that promises to be of much interest is the huge dredging and channeling project now under way in sprawling Mission Bay. This project, which will soon provide one of the finest water playgrounds in America, involves transforming a large area of marshland waste into an island-filled fairyland for water skiers, yachtsmen, and speedboat enthusiasts.

Scripps Institute of Oceanography at La Jolla is a trip most enjoyed by the scientific minded, while engineers will want to see the tremendous San Diego Aqueduct and its recently completed second barrel that brings vitally needed water to San Diego County. Of interest also to all engineers are the numerous structures and naval installations dotting the harbor.

San Diego County—a Sightseers' Mecca

San Diego Convention visitors will want to take in such San Diego County sights as La Jolla, a playground located on steep, rock-bound bluffs with an unparalleled view of the Pacific and the pounding surf. The San Diego Zoo, situated in the middle of magnificent 1,400-acre Balboa Park, attracts over 3,000,000 tourists a year. Cabrillo National Mounment, on the furthest tip of Point Loma overlooking San Diego Harbor, is seen by even more people each year than the Statue of Liberty. Adding to the colorful picture the city presents are the many yacht moorings about the harbor and the picturesque tuna fleets that go out daily.

San Diego, which is the birthplace of the state, is rich in history. Landmarks include the Mission San Diego de Alcala, first in the chain of famed California missions; San Diego Presidio in "Old Town"; and Ramona's Home with its historic and romantic background. As a final attraction Mexico lies only fourteen miles south of the city, giving the visiting engineers a chance to savor a new atmosphere.



Palomar Observatory (left), located just 65 miles north of San Diego on the beautiful "Highway to the Stars," contains the world's largest telescopic mirror. Years in the making, the tower as well as the mirror is a marvel of engineering artistry and skill. Tuna fishing in San Diego is big business. Hundreds of these craft cover the waters west and south of the city, bringing back great hauls of fish that are packed and canned locally and then shipped all over the country.

New Engineering Societies

Task Committee Appraises Requirements

Need for a new engineering center building for office headquarters of the four Founder Societies has been evident over the past decade. United Engineering Trustees (UET), the agency responsible to the societies for meeting that need, has given serious thought to the problem. No definite recommendation as to a new building has yet been made. Under UET Bylaws, its Real Estate Committee "shall advise the Trustees on the administration or sale or other disposal of any real estate of which the Corporation is now or may hereafter become possessed, on the purchase or lease of real estate for use of the Corporation, on the acceptance of real estate by gift or bequest, and on other real estate matters."

At a UET meeting in May, William N. Carey, a trustee of UET from ASCE, was named chairman of the Real Estate Committee, and the committee was charged with solving the problem of a new building promptly. The new chairman organized a Task Committee, which was formally authorized by UET on June 29, 1954, and which is composed of staff members of the five societies now directly involved in obtaining a new building. (The AIChE had joined the original four societies, the actual owners of the present building, in the current planning for a new engineering center.) The Task Committee consists of the following: Peter J. Apol, AIME; N. S. Hibshman, AIEE; Water Letroadec, ASME; F. J. Van Antwerpen, AIChE; John A. Zecca, ASCE; and William N. Carey, UET, Chairman.

There follows a résumé of the findings, conclusions, and recommendations of the Task Committee, dated as of November 1954.

Is present building adequate?

Our present building in New York lacks but a year of being half a century old. It was designed and built to meet the needs of the societies in 1905 when both their annual meetings and board meetings were held in the building. The auditorium, second floor, and ground floor are waste space today, retrievable only at a cost far beyond their worth. With but 76,000 sq ft of usable floor area in the building, exclusive of auditorium areas, the building is too small to provide for any needed expansion. The UET architect has estimated the cost of a remodeling and modernizing job on the present structure at $1,340,000. This would provide 22,500 sq ft of additional office space, at about $60 per sq ft. If the present site were to be used, it is the opinion of the Task Committee that the present building should be razed and a new structure erected.

Can the present land and building be sold?

The land on which the Engineering Societies Building, at 29–33 West 39th St. is located, was purchased outright by "members and friends" of AIME, ASME and AIEE and was presented to them at a cost said to be $541,380.18. As soon as the present building was completed in 1907 it was occupied by the three Societies. Three floors were added in 1917 when ASCE joined the group, and ASCE still occupies the upper two of the three floors that were added. The building is now sixteen stories high. Andrew Carnegie directly paid for the original 1907 construction. In a letter dated March 14, 1904, he announced the gift as follows:

"It will give me great pleasure to devote, say, one and a half million dollars for the erection of a suitable union home for you all in New York City. With best wishes,
Very truly yours
Andrew Carnegie"

Of Mr. Carnegie's gift $450,000 went for the construction of the Engineers' Club of New York (the rear of the club property abuts on the Engineering Societies property and faces 40th St.) and $1,050,000 was used to construct the Engineering Societies Building. Each of the three Societies, AIME, ASME, and AIEE, shared equally in the building as well as the property it occupies.

For the 1917 construction, ASCE paid $262,500 to UET, thereby becoming an equal co-partner in the ownership of the land and the building as it stands today.

The neighborhood has depreciated in the past fifteen years, and West 39th is normally choked with trucks and workers from the coat and suit and allied industries. The land on which the building is located is worth less today than it cost fifty years ago. Firm offers and New York real estate expert opinion indicate that the property can be sold for $1,000,000 or slightly better.

Through the years, UET has accumulated a "Depreciation and Renewal Fund," which has been invested in securities that have a current market value of $1,144,300. Thus at least $2,000,000 is immediately available toward construction of a new Engineering Societies Center Building.

How much space is needed?

The Task Committee agrees with earlier UET estimates that a building with about 215,000 sq ft of gross floor area (175,000 sq ft usable) would suffice to meet present and foreseeable future needs. January 1954 figures show that the four Founder Societies plus AIChE have a combined membership of 156,000 and a total of 350 employees. By 1980, 26 years hence, the membership will have grown to an estimated 295,000 and the staff employees to at least 500.

By 1980 the net or usable floor space requirements of 175,000 sq ft might be allocated somewhat along these lines:

The five Societies, EJC, UET, and ECPD . . .	100,000 sq ft
The Engineering Societies Library	25,000 sq ft
Available for rental	50,000 sq ft
Total	175,000 sq ft

Provision for rental space would permit the accommodation of a number of affiliated engineering societies.

Where should the center be located?

Currently the following five cities (listed alphabetically) are receiving serious consideration as possible sites for the new center: Chicago, New York, Philadelphia, Pittsburgh, and Washington, D.C. The Task Committee gave careful study to several limiting factors it believes are important in selecting a location for the center: Availability of personnel for staff and working committee requirements; accessibility of banking and postal services; ready market for supplies, materials, and general services; location in relation to travel on Society business; and availability of publishing facilities for Society publications. The Committee believes that these factors could be adequately met in any of the five cities named.

What type of building is needed?

The functions of an Engineering Societies Center Building are about equally adaptable to either a multi-story or a two-story building. A study of estimates of cost for construction and subsequent operation and maintenance shows a substantial advantage favorable to the two-story building. It is estimated that a two-story building having a gross floor area of 215,000 sq ft would cost from 3.5 to 4.5 million dollars to construct, depending on the exterior architectural treatment and on the differing costs of building materials in place in the cities listed. A seven-story building

Center Building Studied

similarly has been estimated to cost from 4.3 to 5.1 million dollars. Accordingly the Committee concludes that factors of first cost, operation, and maintenance alone are important enough to warrant decision in favor of a two-story building wherever located.

How much will a site cost?

Interested groups in several cities, including the five already named, have made proposals to UET regarding a building site. Some have made purchase proposals at figures not yet firm; others have offered to make UET a gift of a site. A Pittsburgh group has done both and in addition is offering a cash gift said to range from $1,300,000 to $1,500,000 depending on the site selected. A substantial cash contribution has been indicated from a Chicago group, and a site has been offered as a gift. At the time of its report the committee knew of no tangible offer of a gift of land or money in connection with any New York City site. Some sites in the cities considered involve obligation on the part of the buyer to relocate present tenants; others require legislative action before a lease can be executed or the title transferred; and still others might not be available for construction within one to five years.

Which sites are favored?

Based on its report and the information available to it, the Task Committee has recommended that further investigation of each of the following two sites be instituted in sufficient detail to permit subsequent formal action looking toward a commitment to cover either of them. Both have been offered as outright gifts along with other inducements. These are a 4½-acre site in Chicago offered by the Illinois Institute of Technology at the north end of its campus and a 4- to 5-acre site in Pittsburgh, known as Shenley Park, near the University of Pittsburgh and Carnegie Institute.

Five Presidents Invite Definitive Proposals

At a joint meeting of the Real Estate Committee of UET and the Committee of Five Presidents on November 4, the report of the Real Estate Committee's Task Committee (a résumé of which is recorded above) was presented and considered. After full discussion both bodies recorded their thanks to the Task Committee for the excellence of the report, but neither body took an official position on its recommendations.

The Real Estate Committee referred the report to UET and voted to hold the Task Committee in readiness for possible additional tasks. The Real Estate Committee consists of W. N. Carey, chairman, representing ASCE; E. C. Meagher, AIME; and W. F. Thompson, ASME.

At a separate meeting on November 4 the Committee of Five Presidents, which was appointed by the constituent societies to take such steps as it deemed desirable to expedite decisions on the subject of the new Engineering Societies Center Building, gave further consideration to the Task Committee's Report. A building containing approximately 200,000 sq ft of gross area was recommended. Of the five locations presented, viz. Chicago, New York, Philadelphia, Pittsburgh, and Washington, D.C., the capital city was rejected because of its lack of industrial concentration, and the absence of necessary manpower for working committees and other technical requirements.

Because it believes that inducements or benefits may be offered, in addition to the voluntary and unsolicited proposals now in hand, when the several societies have reached a final decision as to the location of the center, the Committee of Five Presidents is inviting interested groups to submit final complete and definitive proposals they may wish to offer or proposals supplementary to those already submitted. Proposals are to be sent to Elgin B. Robertson, Chairman, in care of AIEE Headquarters, 33 W. 39th St., New York, in time to reach that address before January 31, 1955. The Committee meets again on February 1 for the purpose of making a conclusive recommendation to the constituent societies as to the city in which the Engineering Center is to be located.

Those present were Daniel V. Terrell, ASCE; L. F. Reinhartz, AIME; L. K. Sillcox, ASME; F. S. Blackall, Jr., alternate for ASME; C. G. Kirkbride, AIChE; R. P. Kite, alternate for AIChE; and the chairman, Elgin B. Robertson, AIEE.

UET Recommends New York for Center

Ten of the twelve trustees of United Engineering Trustees, Inc., met on November 15 to consider the location of the Engineering Societies Center Building. It received with thanks the report of the UET Task Committee, a résumé of which appears above.

An agreement to base preliminary estimates on a gross floor area of 200,000 sq ft for the building was reached. It was also agreed to recommend to the Founder Societies that they decide to remain in New York. The text of the unanimous action taken is as follows:

"That the Board of Trustees recommend to the Founder Societies that as a first step in acquiring an adequate engineering center building, the location be agreed upon, and

"that in consideration of the greater concentration of members of our Societies and engineers generally near New York than near any other center, for the convenience of these members and their access to their Societies, together with superior facilities in New York, this Board recommends to the Founder Societies that they decide to stay in New York, and to promptly direct their representatives on UET to proceed to acquire plans for early expansion in New York City as their headquarters, and

"that on acceptance of this step by the Founder Societies, industry be informed of the plans, and that arrangements be made to accept gifts toward payment for the new engineering center."

This action was said to be based on a feeling among the Trustees that no location except New York would be likely to result in unanimous acceptance by the five Societies concerned. UET requested its Real Estate Committee to investigate practicable sites in New York City in sufficient detail to permit final commitments and to report back at an early date.

The trustees present were Chairman James L. Head, and Messrs. Walter J. Barrett, Waldo Bowman, George W. Burpee, Wm. N. Carey, James S. Fairman, Joseph L. Kopf, E. C. Meagher, A. G. Oehler and Willis F. Thompson.

ASCE Budget for 1955—A Record

The Board of Direction has approved the largest budget in ASCE history for the fiscal year 1955. In the November issue (pages 70–72) the approved recommendation of the Budget Committee, of which Vice-President Enoch R. Needles is chairman, were explained in detail. A graphical presentation of the various sources from which the Society expects to draw its income during 1955 is given here. Another chart shows how it is planned to use the anticipated income for the benefit of members, and a third indicates which activities are to be supported more fully from a financial standpoint next year than in the year just past and the extent of the additional support. Table I shows the figures in more detail.

A sum totaling $1,204,200 is expected in income. The largest part of this will come from entrance fees ($44,000) plus dues ($654,800), the two together accounting for 58 percent of the anticipated income. Income from advertising in Civil Engineering ($315,000) plus subscriptions and sale of publications ($112,000) are expected to make up another 36 percent of our total income. Rent from the Society's property at 220 West 57th St., plus interest on securities ($41,600), adds another 3 percent, while smaller incomes from Annual Convention tickets, badges, certificates and prizes are responsible for the remaining $37,000 (3 percent) of the anticipated total.

While the budget has been balanced, that is, the budget total expenditure of $1,204,300 is expected to equal the anticipated income, it is a conservative budget. Judging from the record of the Society's past operations, its income may exceed the estimate and its expenditures will probably be less than anticipated. There should remain at the end of the year a small surplus to be added to the Society's reserves.

The cost of the Society's technical publications—Proceedings, Transactions, Civil Engineering, manuals, reprints, the ASCE membership roster, and the Official Register—is expected to total $567,300, or 47 percent of the budgeted expenditures for 1955, an increase of $21,246 over the actual amount spent in 1954. These costs include all editing, printing, paper, and the expense of procuring advertising. It is expected that the entire cost of producing Civil Engineering will again be met by advertising income.

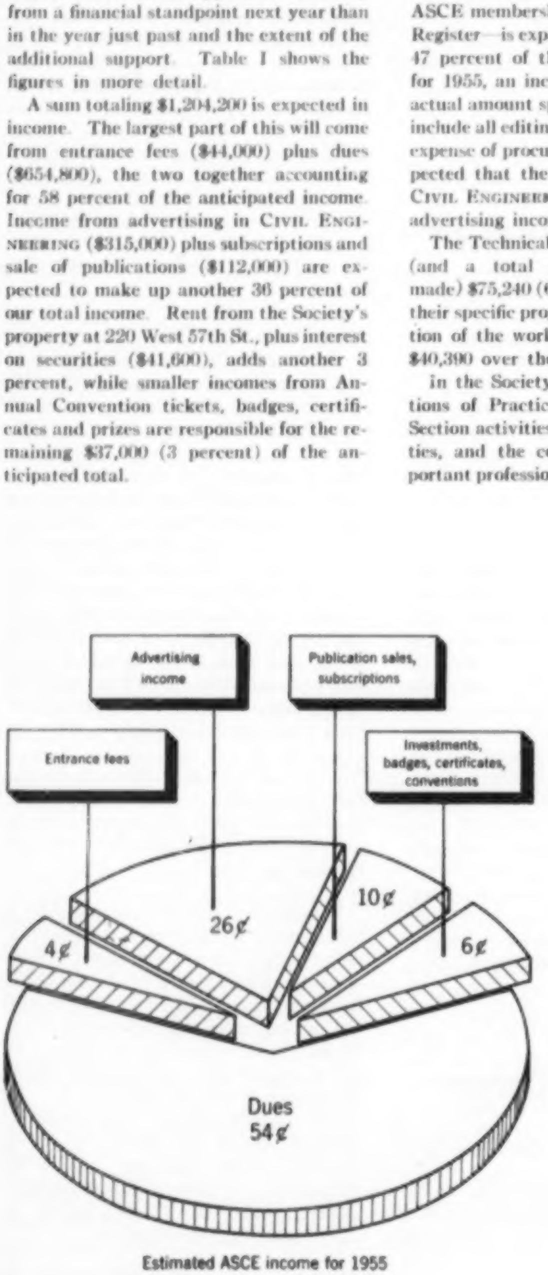
The Technical Divisions have requested (and a total appropriation has been made) $75,240 (6 percent) for carrying out their specific programs and the administration of the work. This is an increase of $40,390 over the amount spent in 1954.

In the Society's Department of Conditions of Practice are included all Local Section activities, Student Chapter activities, and the consideration of such important professional matters as engineering education, registration, professional practice, salaries, employment conditions, Junior Members, national water policy, public relations and ethics. Expenditures budgeted for all these activities total $132,800 or 11 percent of the 1955 budget and $44,289 more than was spent during 1954.

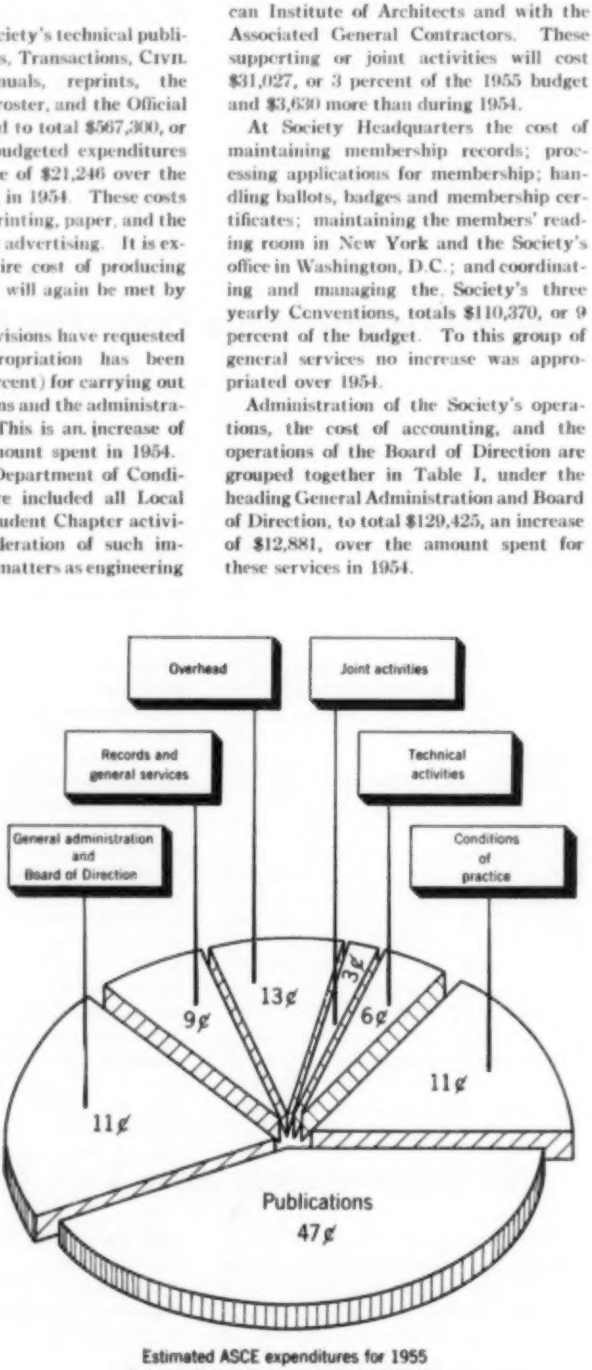
Joint activities include our proportional cost of the support of the Engineering Societies Library, Engineers Joint Council, Engineers Council for Professional Development, the National Council for State Boards of Engineering Examiners, the American Standards Association, and our joint-committee activities with the American Institute of Architects and with the Associated General Contractors. These supporting or joint activities will cost $31,027, or 3 percent of the 1955 budget and $3,630 more than during 1954.

At Society Headquarters the cost of maintaining membership records; processing applications for membership; handling ballots, badges and membership certificates; maintaining the members' reading room in New York and the Society's office in Washington, D.C.; and coordinating and managing the Society's three yearly Conventions, totals $110,370, or 9 percent of the budget. To this group of general services no increase was appropriated over 1954.

Administration of the Society's operations, the cost of accounting, and the operations of the Board of Direction are grouped together in Table I, under the heading General Administration and Board of Direction, to total $129,425, an increase of $12,881, over the amount spent for these services in 1954.



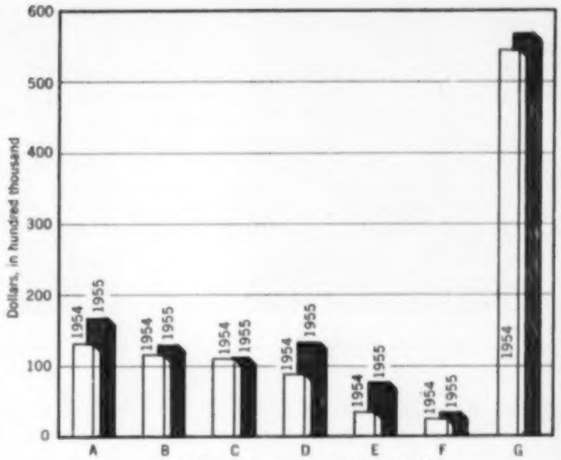
Estimated ASCE income for 1955
Total budgeted income $1,204,200



Estimated ASCE expenditures for 1955
Total budgeted disbursements $1,204,200

TABLE I. BUDGETS FOR 1954 AND 1955 COMPARED

Category	Items	Actual Budgets 1954	Actual Budgets 1955	Increase
A	Overhead	$130,726	$158,038	$27,312
B	General Administration and Board of Direction	116,544	129,425	12,881
C	Records and General Services	110,214	110,370	156
D	Conditions of Practice	88,511	132,800	44,289
E	Technical Activities	34,850	75,240	40,390
F	Joint Activities	27,397	31,027	3,630
G	Publications	546,054	567,300	21,245
	Total	$1,054,296	$1,204,200	$149,904



ASCE expenditures compared 1954-1955

Headquarters office overhead, rent paid to United Engineering Trustees for the operation of the Engineering Societies Building, retirement payments, and Social Security taxes, together with new furniture and equipment, make up the anticipated general overhead costs budgeted at $158,038, or 13 percent of the budget, and an increase of $27,312 over the expenditures for these operations in 1954.

It is to be noted that the additional funds, $149,904 more than was available in 1954, will permit expanded programs in both professional and technical fields of the Society's operations and at the same time will enlarge the service to individual members.

Copies of the Society's Financial Statement for the fiscal year 1954 ending September 30, including the Treasurer's Report, will be distributed to those in attendance at the San Diego Convention. It will also be available after January 15, 1955, to any member desiring a copy. Requests should be sent to the Executive Secretary at Society Headquarters.

EUSEC Conference Studies Engineering Education

Post-college training was one of the important subjects of discussion at the second Conference on Engineering Education of the Europe-United States Engineering Congress (EUSEC), held in Zurich this fall. The five United States members of EUSEC delegated their representation to the Engineers Council for Professional Development, which sent as representatives L. F. Grant, its chairman, who supplied a report from which this item is prepared; Dean Thorndike Saville, chairman of its Education Committee and president of Engineers Joint Council; and Dean L. E. Grinter, immediate past-president of the American Society for Engineering Education. Because of the interest in post-college training, it was believed desirable to add two industrialists to the delegation. They were Maynard M. Boring, manager of the Technical Personnel Division of the General Electric Co., and Dr. S. B. Ingram, director of education and training for the Bell Telephone Laboratories, Inc., who were made available through the courtesy of their respective companies and rendered valuable service.

Preliminary arrangements were made by the three Institutions of Great Britain, and the local arrangements in Zurich by P. Soutter, general secretary of the Swiss Society of Engineers and Architects.

Countries represented, in addition to the United States, were Belgium, Denmark, Finland, France, West Germany, Holland, Norway, Sweden, Switzerland, and the United Kingdom.

In a discussion of general education on pre-university level, it was brought out that in some countries, notably Switzerland and West Germany, from six to nine months of engineering experience is required before entry to a university. In a session on education at the university level, much interest was shown in qualifications of the teaching staff, particularly in Dean Grinter's outline of requirements in the United States. Discussion revealed that the use of part-time professors drawn from industry is more common in Europe than in the United States. Another session dealt with the practical training of students at the university level, including the cooperative system in use in some universities in the United States and at Glasgow University in Scotland. The principal contributors to this discussion were the Belgian, United Kingdom, and United States delegations.

A special committee discussed the subject of the international exchange of students, a project handled by the International Association for the Exchange of Students for Technical Experience. While some 5,000 exchanges for vacation work are carried out annually in Europe and Canada, the results in the United States have been disappointing except for one year when the students' organization of Massachusetts Institute of Technology undertook to find positions for European students wishing to come to the United States. It is hoped that as a result of the meeting better arrangements can be made in the future.

Daniel W. Mead Prizes Given for Essays on Ethics

Alfred E. Waters, II, J. M. ASCE, from LaCanada, Calif., and William H. Blackmer, J. M. ASCE, from Fresno, Calif., are the winners of the 1954 Daniel W. Mead Prizes. These prizes, which are awarded to a Junior Member and a student member of ASCE for the two best papers on an aspect of professional ethics, will be presented at the San Diego Convention in February.

Alfred E. Waters, the winner of the Junior Member prize consisting of $50 in cash and a certificate, wrote on the subject of "The Ethics of the Resident Engineer and His Relation with the Contractor." After three years in the Army Corps of Engineers he obtained his B.S. and M.S. degrees in civil engineering from the California Institute of Technology where he was the president of the Student Chapter of ASCE. He also has been active in the Los Angeles Junior Forum, in which he has held numerous offices. He is now assistant treasurer of the Section. Mr. Waters is currently employed as structural designer with Quinton Engineers, Ltd., of Los Angeles.

William H. Blackmer, who is now a Junior Member of ASCE, is the recipient of the student prize of $25 and a certificate. He dealt with the subject, "To What Extent Should an Employer Give Credit to Assistants and Subordinates for Engineering Work under his Supervision," while he was a member of the Student

Alfred E. Waters, II

William H. Blackmer

Chapter at the University of California. After naval service Mr. Blackmer received his B.S. in civil engineering from the University of California where he held the Newhouse Foundation Scholarship. In addition to being the president of the Student Chapter he was elected to Chi Epsilon and Tau Beta Pi. He was recently employed by the California Division of Water Resources and is now a civil engineer with the consulting firm of Stoddard and Karrer of Fresno, Calif.

Board Confirms New Committee Personnel

The Board of Direction, at its meetings in New York in October, confirmed appointment of ASCE committees for the coming year. The committees of the Board follow (all terms expire October 1955).

Executive Committee: Wm. R. Glidden, Chairman; Enoch R. Needles, Vice-Chairman; Daniel V. Terrell, Walter L. Huber, Mason G. Lockwood, Louis R. Howson, and Frank L. Weaver.

Honorary Membership: Wm. R. Glidden, Chairman; Enoch R. Needles, Vice-Chairman; Daniel V. Terrell, Walter L. Huber, Mason G. Lockwood, Louis R. Howson, and Frank L. Weaver.

Districts and Zones: Enoch R. Needles, Chairman; Mason G. Lockwood, Louis R. Howson, and Frank L. Weaver.

Professional Conduct: Francis M. Dawson, Chairman; George S. Richardson, Vice-Chairman; Thomas C. Shedd, Raymond F. Dawson, Frederick H. Paulson and Lawrence A. Elsener.

Meetings: Enoch R. Needles, Chairman; Louis R. Howson, Vice-Chairman; Mason G. Lockwood and Frank L. Weaver.

Publications: Samuel B. Morris, Chairman; Jewell M. Garrelts, Vice-Chairman; Glenn W. Holcomb, Oliver W. Hartwell, Ernest W. Carlton, and Don M. Corbett.

Membership Qualifications: Carl G. Paulsen, Chairman; Thomas C. Shedd, Vice-Chairman; M. J. Shelton, Wm. S. LaLonde, Jr., Graham P. Willoughby, and Frederick H. Paulson.

Division Activities: Enoch R. Needles, Chairman; Louis R. Howson, Vice-Chairman; A. A. K. Booth, Jewell M. Garrelts, Samuel B. Morris, ex-officio (Chmn., Publications Committee), and Elmer K. Timby, ex-officio (Chmn., Research Committee).

Conditions of Practice Executive Committee: Mason G. Lockwood, Chairman; Frank L. Weaver, Vice-Chairman; Francis M. Dawson, Graham P. Willoughby, C. B. Molineaux, Lawrence A. Elsener, M. J. Shelton, Raymond F. Dawson, Carl G. Paulsen, and Lloyd D. Knapp.

The Auxiliary Administrative Committees will be:

Annual Convention: Wm. S. LaLonde, Jr., Board Contact Member (1955).

Application Classification: Albert Haertlein, Chairman (1956); Wm. J. Shea, Vice-Chairman (1957); Harold L. Blakeslee (1958); and Wm. S. LaLonde, Jr., Contact Member (1955). Alternates: V. T. Boughton (1955) and L. G. Holleran (1955).

Budget (Terms expire October 1955): Enoch R. Needles, Chairman; F. A. Marston and Edmund Friedman.

Securities (Terms expire October 1955): Walter D. Binger, George W. Burpee, and John P. Riley (committee to select a chairman).

Retirement: C. B. Molineaux, Chairman and Contact Member; John A. Zecca, Secretary; and Wm. J. Shea, Treasurer.

The new Professional Committees are:

Junior Members: Robert A. Marr, Chairman (1957); Finley B. Laverty, Vice-Chairman (1958); George H. Lacy (1955); E. A. Gramstorff (1956); and M. J. Shelton, Contact Member (1955).

Local Sections: C. E. Drummond, Chairman (1955); Frank C. Mirgain, Vice-Chairman (1956); Eugene F. Bespalow (1957); Elmer J. Maggi (1958); and Carl G. Paulsen, Contact Member (1955).

Student Chapters: Leo C. Novak, Chairman (1955); Clifford D. Williams, Vice-Chairman (1956); C. Russell Dole (1957); Charles E. Clarridge (1958); Emory E. Johnson (1959); and Raymond F. Dawson, Contact Member (1955).

Registration of Engineers: Robert E. Stiemke, Chairman (1955); Wm. M. Spann, Vice-Chairman (1957); Harold E. Wessman (1956); David G. Baillie (1958); and C. B. Molineaux, Contact Member (1955).

Salaries: Robert J. Ellison, Chairman (1955); Dewitt C. Greer, Vice-Chairman (1957); Oscar S. Bray (1956); Don H. Mattern (1958); and Graham P. Willoughby, Contact Member (1955).

Employment Conditions: Charles W. Yoder, Chairman (1955); Mauno Backlond, Vice-Chairman (1956); Paul M. Wentworth (1955); Blair I. Burnson (1958); and Lawrence A. Elsener, Contact Member (1955). Alternates: Sterling S. Green (1955) and Charles W. Okey (1955).

Engineering Education: Weston S. Evans, Chairman (1957); Edwin H. Gaylord, Vice-Chairman (1955); Harry A. Williams (1956); Roland P. Davis (1958); and Francis M. Dawson, Contact Member (1955).

Professional Practice: Raymond A. Hill, Chairman (1956); N. T. Veatch, Vice-Chairman (1955); Karl R. Kennison (1957); Herbert C. Gee (1958); and Lloyd D. Knapp, Contact Member (1955).

Appointments to the Technical Committees are as follows:

Research: Elmer K. Timby, Chairman (1955); Robert E. Stiemke (1956); Lowell E. Gregg (1957); Martin A. Mason (1958); and Francis M. Dawson, Contact Member (1955).

Technical Procedure (All terms expire October 1955): Enoch R. Needles,* Chairman; Louis R. Howson, Vice-Chairman; A. A. K. Booth, Jewell M. Garrelts, Elmer K. Timby,† and Samuel B. Morris.‡ In addition, the committee includes the executive committee chairmen of each Technical Division.

New appointments to the Task Committees follow. All terms expire October 1955.

Advisory Committee on EJC Water Policy Panel: Louis R. Howson, Chairman; remainder of committee to be appointed.

George Washington Canal and Locks: U. S. Grant, III, Chairman; A. P. Greensfelder, Co-Chairman; Daniel C. Walser; Frank L. Weaver; and Carl G. Paulsen, Contact Member.

Committee on Atomic Energy: Harry L. Bowman, Chairman; Rolf Eliassen; R. T. Colburn; and Jewell M. Garrelts, Contact Member.

New appointments to the Joint Committees follow:

ASCE-AGC Joint Cooperative Committee (Terms expire October 1955): C. B. Molineaux, Chairman; Mason C. Prichard, and Maurice N. Quade.

ASCE-AIA Joint Cooperative Committee (Terms expire October 1955): Craig P. Hazelet, Chairman; Mason G. Lockwood, and Wm. O. Hiltabidle. Additional appointees authorized.

Engineers Council for Professional Development: Philip C. Rutledge (1955), Harry S. Rogers (1956), Ralph E. Fadum (1957), and A. A. K. Booth, Contact Member (1955).

Engineers Joint Council (for the calendar year 1955): Representatives: C. S. Proctor, D. V. Terrell, L. R. Howson, and Wm. N. Carey; Alternates: W. L. Huber, J. M. Garrelts, W. S. LaLonde, Jr., and F. H. Paulson; W. R. Glidden (ex-officio).

United Engineering Trustees: Waldo G. Bowman (1955), George W. Burpee (1956), and Wm. N. Carey (1958).

John Fritz Medal Board of Award: Gail A. Hathaway (1955), Carlton S. Proctor (1956), Walter L. Huber (1957), Daniel V. Terrell (1958), and Wm. R. Glidden (1955), Alternate.

Washington Award Commission: G. Donald Kennedy (May 1955) and E. M. Fucik (May 1956).

Engineering Foundation: Leslie G. Holleran (1955), Wm. N. Carey (1956), and Elmer K. Timby (1957).

American Association for the Advancement of Science (Terms expire December 31 of year shown): Waldo E. Smith (1955) and Thorndike Saville (1957).

* Chairman, Committee on Division Activities
† Chairman, Committee on Research
‡ Chairman, Committee, on Publications

City Planners Discuss Zoning For Atomic Energy Plants

City planners were urged to study zoning to control the location of atomic energy plants during the City Planning Division's recent City Planning Conference at Lehigh University. In a leading talk entitled "The Impact of Atomic Development on Growth and Planning of Urban Regions," Park H. Martin, executive director of the Allegheny Conference on Community Development, told the audience of over 200 that the impact of nuclear energy from the planning viewpoint "will be one of substitution of one source of energy for those currently in use. In areas where energy sources are presently limited or non-existent, nuclear energy should provide energy sources that may well be an incentive for development and growth of industrial and manufacturing enterprises which do not now exist."

Mr. Martin said that while the use of nuclear energy will reduce air pollution, it will increase the responsibilities of city planners in the disposal of garbage and sewage. "With steam developed by cheap atomic energy," he predicted "the development of central heating plants in cities and towns."

The delegates were warned that disposing of radioactive wastes safely will call for careful city planning in a talk by Arthur E. Gorman, sanitary engineer in the Division of Reactor Development of the U. S. Atomic Energy Commission. "As the atomic energy industry goes forward under the liberalized provisions of the Act of 1954," he said, "it is to be expected that commercial users will want to build plants near centers of population where markets exist for their product." He emphasized that the safe disposal of radioactive wastes will demand "careful advance planning of sites and the careful location of plants on the site in relation to one another and their facilities and evaluation of environmental factors such as meteorology, geology, and hydrology.

"This new industry, he said, offers "an intriguing challenge to private management, scientists, engineers, and public health, planning, and conservation officials."

Nuclear reactors for production of peacetime power can be designed so they are as safe for a community as are conventional power plants, Harold W. Huntley, of the Atomic Power Study of the General Electric Co., Schenectady, N.Y., told the delegates. First off, he said, "it should be realized that atomic power plants cannot detonate like the atomic bomb. Danger . . . would come principally from plutonium, which is toxic even in minute amounts. Fission products produce intense gamma rays and radioactivity induced in other materials in the reactor also represents potential hazards," he added. Mr. Huntley also pointed out that the coolant is more hazardous than the remaining solid materials of the reactor due to its mobility and volatility once released. Even so, he reassuringly concluded, "You may be assured that reactor designs which are approved for installation are as safe as it is humanly possible to make them."

John W. Landis, of the Atomic Energy Division of Babcock & Wilcox, New York, told the group that three of the most important problems now facing the reactor designer would be solved by the so-called homogeneous reactor. He pointed out, however, that corrosion problems of this type of reactor have not been completely solved. He described a homogeneous reactor as one which mixes the fuel, moderator, and coolant often in liquid form, as opposed to a heterogeneous reactor which separates them.

Eleanor H. Frick, Former Office Manager, Dies

Miss Eleanor H. Frick, for many years office manager of the Society at its headquarters, died at her home in New York on November 20 after a long illness. She was 81. At the time of Miss Frick's retirement in 1937 she had been closely connected with the development of the Society for 39 years, coming to it as librarian in 1898 when the organization had only 2,000 members and had just moved to its 57th Street headquarters, and retiring as office manager when the Society numbered 15,000 and was located in its present headquarters. Many members will recall with affection Miss Frick's tireless devotion during these years to many phases of the Society's work, as do the old-timers on the headquarters staff who had the privilege of working with her.

Since her retirement Miss Frick has been active in church and civic work and in the Republican Women's Club. During the war she performed valuable personnel service in New York City's civil defense program.

Eleanor H. Frick

ASCE Past-President E. M. Hastings Dies

Edgar M. Hastings, former chief engineer of the Richmond, Fredericksburg and Potomac Railroad and President of ASCE in 1947, died at his home in Richmond, Va., on November 21 after a long illness. He was 71 years old. Educated at Baltimore City College and Baltimore Polytechnic Institute, Mr. Hastings spent his entire professional life in the field of railroad engineering. He had been associated with the Richmond, Fredericksburg and Potomac Railroad since 1903 and was chief engineer from 1922 until illness forced his retirement a few years ago. During his tenure as chief engineer a number of important bridges were built over the tidal estuaries emptying into the Potomac, and Fredericksburg improvements, consisting of a concrete viaduct through the city and a concrete arch bridge across the Rappahannock, were made.

E. M. Hastings

Elected an Associate Member of ASCE in 1910 and a Member in 1922, Mr. Hastings served as Vice-President in 1943 and 1944. Particularly interested in the education of young engineers, he was chairman of the Society's Committee on Student Chapters (one of numerous committee assignments), and for many years was Contact Member to the Student Chapter at Virginia Military Institute for the Virginia Section. In tribute to his work with the young men at VMI, he was made an honorary member of the class of 1918. He was also president of the Virginia Section for two years. Mr. Hastings had been president of the American Railway Engineering Association.

Certification of Sanitary Engineers Discussed at ASCE Convention

A forum on "Certification of Sanitary Engineers" was an important feature of the Sanitary Engineering Division's Annual Convention program this fall. Rolf Eliassen, M. ASCE, presided over a panel, consisting of Earnest Boyce, B. A. Poole, Alvin F. Meyer, Jr., W. A. Hardenbergh, Ray E. Lawrence, and H. B. Gotaas, all Members of ASCE.

The subject of certification of sanitary engineers was first discussed in 1950 at a meeting of the Executive Committee of the Sanitary Engineering Division. In 1953 the ASCE Board of Direction approved the idea of certification of sanitary engineers. In April 1954, the Joint Committee for the Advancement of Sanitary Engineering, in which ASCE participates, met in Washington, D.C., and set up a Committee on Certification. Administrative responsibility for this committee currently lies with the Board of Direction of ASCE as the only incorporated body among the groups interested.

Under this committee, the panel met at the Statler on October 18 in order to: (1) Report on the progress of the committee, and (2) learn what the Division members want in the matter of certification. Professor Eliassen emphasized that the Committee is not trying to remove sanitary engineering from the five existing organizations participating in the Joint Committee. Mr. Lawrence urged that all organizations interested in sanitary engineering should participate in the certification organization, thus minimizing the possibility of splinter organizations.

The committee is establishing fees, general requirements and examination standards for certification. Proposed requirements are: (1) A professional engineering license, (2) four years of college and four additional years of experience, and (3) a "grandfather" clause under which engineers now in practice may qualify without taking the examination if they have completed perhaps 15 years of experience.

The roster of those receiving certification will be known as the American Academy of Sanitary Engineers. Colonel Meyer explained that the medical profession, with which many sanitary engineers work closely, fails to understand clearly the qualifications for sanitary engineering, feeling that any graduate engineer is satisfactory for such work. Establishment of this directory of recognized sanitary engineers from which members of parallel non-engineering groups would be barred, would thus be an important step. It is important that recognition by the certification body be of a nature that the public will understand.

The Committee needs to establish a legal entity. The ASCE Board of Direction is the only agency under which the Committee can properly operate. However, it is felt that the Board is already extremely busy and should not have the administration of the committee permanently added to its duties. It has been proposed to incorporate the Joint Committee, under the suggested name of the "American Sanitary Engineering Inter-Society Board." Under this board would be a Specialties Committee, consisting of three board members and three members from outside the board. This committee would maintain qualifications.

Creation of a certification board will not change Civil Service laws or other laws, Colonel Meyer emphasized.

Following establishment of the certification procedure, it is hoped by all concerned that EJC will take measures to sponsor the certifying board. Warren McCabe, chairman of the EJC Commission on Joint Specialties, was optimistic that the necessary adjustments in existing patterns among the engineering societies could be accomplished to make way for the new group.

The strengthening effect of a certifying movement was stressed by many. The certifying board would cut across existing engineering-society lines, tending to consolidate and unify sanitary engineers into a compact group, perhaps eventually having a similar effect on other engineering branches. Sanitary engineers compete with the medical profession and by this move would adopt standards similar to those of the medical profession—not for personal benefit but to enable engineers to give maximum service to the public.

Mr. Hardenbergh reviewed the development of the Sanitary Corps of the Army during World War II. In establishing Army regulations for this new group, there was no precedent for setting up qualifications of men to be commissioned. Advice was sought from many groups, but the need for a specific organization in the field was noted. "Good will and good wishes do not take the place of the work of a dedicated organization," observed Mr. Hardenbergh.

Discussers warned the committee to think broadly, and to avoid concentrating on too small a concept. The committee was admonished to proceed slowly and not fail in its efforts through haste, for this movement may have value as an example to the entire profession if it succeeds.

A point that was discussed at some length was the importance, in connection with the certifying movement, of maintaining a constant flow of qualified sanitary engineers to fill today's great need for them.

It was pointed out that in the past the medical profession had expressed its approval of certification of sanitary engineers, and that a poll of the Sanitary Engineering Division in 1952 showed an encouraging attitude within ASCE.

ASCE "Transactions" For 1954 Available

The 66 technical papers comprising the currently available 1954 Transactions (Volume 119) will continue to uphold the high standards traditional with this publication. Beginning with a three-part symposium entitled "Ice Pressure Against Dams" and closing with President Daniel V. Terrell's annual address, the volume occupies 1,472 pages. The complete list of papers included was published in the October issue (page 98). Nearly all the Technical Divisions have sponsored selected papers, insuring breadth of viewpoint and quality of subject matter. In addition there are discussions from distinguished engineers from all over the United States and abroad and 36 abstracts of memoirs of deceased members.

Copies are available to both members and non-members of the Society in the usual paper, cloth, and Morocco-grained bindings. Those who are not yearly subscribers to Transactions and who have not previously ordered Volume 119 by other means may do so by use of the coupon provided in the advertising department.

EJC and Edison Foundation Study Engineer Shortage

Educators, engineering and scientific societies, and industry joined in a program directed at improving secondary education in science and technology at the closing session of the fifth annual Thomas Alva Edison Foundation Institute, held at Glenmont, N.J., in October under joint auspices of the Foundation, the Engineering Manpower Commission of Engineers Joint Council, and the Scientific Manpower Commission. Studying the problem of bringing into line the quantity and quality of our scientific training with the rapidly mounting demand for competent personnel, the assemblage of experts agreed that the close cooperation of all three groups represented will be essential in meeting the threat of today's "technological cold war."

Among the means proposed to achieve the objective, as expressed in a report adopted by the entire conference, were intensive efforts to publicize the need for more highly trained teachers and students in the technological field. Such spreading of the gospel of scientific preparedness, it was suggested, should be undertaken at all levels, from government, industry, and scientific societies down to communities.

EJC Schedules General Banquet and Assembly

Engineers Joint Council is planning its first general assembly and banquet, which will be held at the Hotel Statler in New York on January 21. While a broad variety of topics will be taken up by committees and speakers during the day-long program, the basic theme will be the increase of unity in the engineering profession.

Discussion will deal with the engineering manpower shortage, employment conditions as they affect engineers, the national water policy which has occupied the Council's attention for several years, peacetime nuclear developments, and finally the future usefulness of EJC to affiliate and associate societies.

ASCE Membership as of November 9, 1954

Members	8,766
Associate Members	11,195
Junior Members	17,715
Affiliates	69
Honorary Members	44
Total	37,789
November 9, 1953	36,643

Transactions of World Power Conference Ready

Availability of the long-awaited *Transactions* of the Sectional Meeting of the World Power Conference, held in New Delhi, India, in 1951, is announced by the United States National Committee of the World Power Conference, 29 West 39th Street, New York 18, N.Y. Volumes I, II, and III may be obtained at £9 15s per set, from the secretary of the Indian National Committee of the World Power Conference, 8 Gokhale Road, Calcutta 20, India. Volume IV, the index, will be sent to purchasers of complete sets when it is ready.

The *Transactions* cover six technical sessions, which were held for discussion of the theme of "Utilization of Power in its Various Aspects," under twelve subheadings of two main subjects—the utilization of electricity in agriculture and coordination of the development of industries and power resources. All the sessions emphasized the importance of industrial development in raising the standard of living of underdeveloped countries and the need for close coordination between such development and the provision of necessary power supplies.

ASCE Committee on Sedimentation Sponsors Conference

Attending the Conference on Mechanics of Sediment Transportation, held in Fontana Village, N.C., in October are (left to right): Alvin S. Anderson, assistant professor of hydraulics, University of Minnesota; Walter L. Moore, professor of civil engineering, University of Texas; Harold V. Peterson, geologist, U.S. Geological Survey, Denver; Fred H. Larson; regional irrigation engineer, Soil Conservation Service, Upper Darby, Pa.; and Finley B. Laverty, chief hydraulic engineer, Los Angeles Flood Control District, Los Angeles. Aimed at exploring means of improving the methods of controlling and predicting the movement of sediment, the conference was initiated by the Hydraulics Division's Committee on Sedimentation and co-sponsored by the University of Tennessee and the National Science Foundation.

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the tenth of the month preceding date of publication.)

The use of curtain-wall construction in Pittsburgh's Gateway Center Building was discussed at the **Akron Section's** first dinner meeting of the new season, which was held at Smithville, Ohio. C. R. Clauer, chief engineer for United Steel Fabricators, Inc., Wooster, was featured speaker.

Problems involved in building the $800,000,000 New York State Thruway, now approaching completion, were reviewed at a recent **Buffalo Section** meeting by Charles B. Waters, district engineer for the New York State Department of Public Works. During the evening the Section paid warm tribute to its veteran member, Edward P. Lupfer, who is one of the Society's three new Honorary Members.

A talk on modern methods of predicting the weather initiated the **Central Ohio Section's** first meeting of the season. Howard Kinney, of the U. S. Weather Bureau, was the speaker.

"When I pay taxes I buy civilization," said Oliver Wendell Holmes, and this was the theme developed by C. A. Harrell, city manager of Cincinnati, in the enlightening feature talk at the **Cincinnati Section's** October meeting. Speaking on "City Hall and Citizens Relations," Mr. Harrell discussed what citizens have a right to expect of city government and what city government, in its turn, can justifiably expect from its citizenry. Another recent Section meeting was devoted to an inspection tour of the Walter C. Beckjord Station of the Cincinnati Gas & Electric Co., near New Richmond, Ohio. L. L. Smoot, company engineer in charge of the project, did the honors.

Formation of a Junior Forum is being studied and discussed by the **Cleveland Section.** The October meeting featured a discussion of the purpose, functions, and operation of the city's newly created Department of Port Control, which was set up about a year ago to plan intelligently for future aviation needs and for the future needs of commerce along the lakefront. William Rogers, director of the new department and the principal speaker, pointed out that the commercial development of the city's lakefront facilities assumes new importance in view of the fact that Cleveland will become an international port when the St. Lawrence Seaway is completed. Several European companies have already inquired about dock and warehouse space, he said.

In a talk entitled "The Science of Engineering and the Art of Living" given at the October 19 dinner meeting of the **Delaware Section,** Francis X. Gallagher, public relations consultant, defined the engineering leader as possessing the Aristotelian attributes of fortitude, temperance, prudence, and courtesy, plus the "more modern virtues" of liberality and courtesy. As examples of local engineers who have demonstrated the "science of engineering" to a high degree, he singled out Howard K. Preston, who recently retired after 42 years as an engineering teacher at the University of Delaware, and Alfred E. S. Hall, retired duPont Company engineer.

Junior Members discuss Junior activities at the Mid-South Section's annual meeting in the left photo. They are (in usual order) W. Glen Francis, W. W. Graham, and Robert H. Kuhlman. The view at right shows Sanford M. Wilbourn, Robert M. Scholtes, Student Chapter Faculty Adviser at Mississippi State College; J. R. Bissett, retiring Director of the Section and former Faculty Adviser at the University of Arkansas; and Thomas W. Stallworth, Faculty Adviser at the University of Mississippi.

The faculty of Rose Polytechnic Institute at Terre Haute, Ind., was host to the **Indiana Section's** October meeting, at which James Adamson, labor relations consultant, spoke on the relationship between the professional employer and employee and labor unions. Mr. Adamson strongly urged his hearers to affiliate with a dues-paying professional organization as the best means of increasing their professional status. In a review of the Board of Direction's Annual Convention activities ASCE Director Don Corbett dwelt particularly on the provisions of the 1955 budget that affect the Local Sections.

Engineers can still learn from the ancient builders. This must have been the message derived from the featured talk at the **Intermountain Section's** October dinner meeting, given by Adelbert Diefendorf, head of the civil engineering department at the University of Utah. Discussing his engineering experiences in Guatemala, Professor Diefendorf showed slides of buildings over 400 years old in which the stone arch construction is still sound though the arches were made without mortar. Some of the arches have been damaged by earthquake, but they still remain in place, many of them supporting considerable load.

The proposed Iowa Toll Road was discussed at a joint dinner meeting of the **Iowa Section** and the Iowa City Engineers' Club, held in Iowa City on October 25, with S. P. Brown, of Coverdale & Colpitts, the principal speaker.

Recent **Ithaca Section** doings include the annual outing, at which the staff of the Cornell Summer Survey Camp entertained members of the Section and their families. Surveying contests enlivened the afternoon, and the after-dinner speech—by Florian Davatz, of the Kern Instrument Co.—dealt with the development of surveying instruments. At another recent meeting Donald J. Belcher, associate professor of civil engineering at Cornell University, gave an illustrated talk on work he has been doing in Brazil.

Members of the **Kansas Section** attending a joint meeting with the Wichita Society of Professional Engineers, held in Wichita on October 22, heard Jack Kice, manager of the application engineering and service department of the Coleman Co., discuss the air conditioning of homes, with special reference to a research project of the National Association of Home Build-

ers at Austin, Tex. At the Section's regular October meeting Robert M. Hoover, president of the Kansas City Bridge Co., described the construction of the main river piers of Kansas City's new Paseo Bridge.

The use of filtration dams as an aid in the solution of Mexico City's water problem was discussed at a meeting of the **Mexico Section,** held in Mexico City on September 27, by Francisco J. Serrano, local civil engineer and architect; Antonio Rodriguez, of the Department of Hydraulic Resources; and Leopoldo Farias, civil engineer. According to Mr. Serrano, the project is feasible, but it will take a long time for the investment to be recovered. The dams and dikes that are to be built in the southern outskirts of the city will aid in relieving the water shortage by helping the soil to recover its water content. It is lack of water in the soil that causes the city's foundation problems, Mr. Serrano said.

The **Miami Section** is represented on the Metropolitan Miami Municipal Board. At the Section's October meeting Gen. Robert G. Lovett described the handicaps under which the Thule, Greenland, Airbase was constructed.

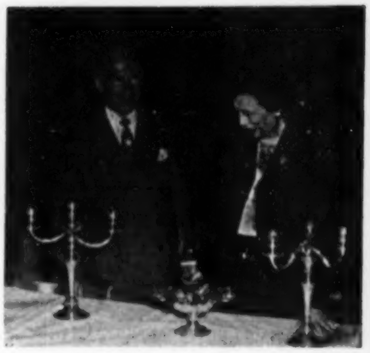
New **Mid-South Section** officers, elected during the annual meeting in Little Rock, Ark., on October 22, are A. W. Hardy, of Little Rock, president, and Frank T. Quinn, of Memphis, Tenn., vice-president. Earl C. Meserve, of Little Rock, will continue as secretary-treasurer. Study of Junior Member and Student Chapter affairs loomed large in the program, which also featured a student paper competition. First prize of $30 went to John A. Johnson, of the University of Mississippi, for a paper entitled "Can Improved Highways Substantially Reduce Highway Accidents?"; second prize of $20 to Raymond N. Shaw, of the University of Arkansas, for a paper on the "Use of Photogrammetry in Highway Design and Construction"; and third prize of $10 to Charles L. Campbell, of Mississippi State College, for a paper on "Thin Prestressed Concrete Sections."

On October 2, fifty engineers from Maine, New Hampshire, and Vermont went to Littleton, N.H., for a luncheon meeting and inspection trip of the **Maine Section's New Hampshire Branch.** Objective of the trip was the 150,000-kw hydroelectric station currently being built on the Connecticut River for the New England Electric System. The hosts were members of the engineering staff of Ebasco Services, Inc., the supervising engineers for the job. Jack B. McKamey, project manager for Ebasco, spoke at the luncheon.

Gordon E. Herkenhoff is moving up from second to first vice-president of the **New Mexico Section.** He succeeds L. E. Wheeler, who resigned because of other time-consuming commitments. Arthur A. Mosher will be second vice-president for the rest of the year. The secretary of the Section, Rufus Carter, Jr., is also editor of the Section's interesting and informative quarterly bulletin, now completing its second year of publication.

The **Oregon Section** has completed the difficult task of selecting the seven engineering wonders in the Pacific Northwest, an area teeming with wonders. First on its list are the federally owned and operated dams on the Columbia River system in Montana, Idaho, Oregon, and Washington—Hungry Horse, Albeni Falls, Grand Coulee, Chief Joseph, McNary, the Dalles, and Bonneville dams. In descending order, the other six wonders are the Hanford Works of the Atomic Energy Commission; the Columbia Basin Project (irrigation); the Willamette Basin Project (flood control and power); the Boeing Aviation Company's plants at Renton and Seattle, Wash.; the Lake Washington floating bridge; and the jetties at the mouth of the Columbia (navigation).

The **Philadelphia Section's** new season got off to a good start in October with a joint inspection trip and meeting with the Metropolitan-Philadelphia Chapter of the American Public Works Association. One of the public works projects visited during the afternoon—the shaft and head works of the tunnel for the new Lower Delaware Intercepting Sewer—was discussed at the dinner meeting by Allen R. Shackleton, general superintendent for the James N. Driscoll Co., contractor for the work. The program also featured a talk by Samuel S. Baxter, city water commissioner and past-president of the Section, on the city's water and sewerage facilities considered as big business.



James A. Higgs, of Atlanta, Ga., who retired in October as ASCE Director for District 10, and Mrs. Higgs examine a pair of sterling silver candelbra and center piece, the gift of the Georgia Section in recognition of "many years of loyal service to the Society and the Section." The presentation was made at the Section's October meeting—appropriately arranged by the Junior Members, in whom Mr. Higgs has long had a special interest

New officer for the **Philadelphia Section's Junior Forum** are Price Fernon, president; Jack R. Stiller, vice-president; Benjamin Givens, secretary; and Frank Sadofsky, treasurer.

Desert Area Branch of the Los Angeles Section is host to Southern California engineering societies at the U.S. Naval Ordnance Test Station in the Mojave Desert. Plans for the field day, which drew 575 guests representing nine societies, are outlined by Martin J. Snow (second from left), president of the Desert Area Branch and assistant head of the Engineering Division at the NOTS. Shown, left to right, are Finley Laverty, past-president of the Los Angeles Section; Mr. Snow; Trent Dames, past-president of the Section; Wright M. Price, president of the San Bernardino-Riverside Counties Branch; George Conahey, secretary-treasurer of the Ventura-Santa Barbara Counties Branch; Norman Jaffe and Frank H. Squires, of Los Angeles; I. I. Shull, secretary-treasurer of the Desert Area Branch; Ralph S. McLean, president of the Orange County Branch; Sterling S. Green, president of the Los Angeles Section; L. A. Coleman, program chairman for the Los Angeles Sections; and F. F. McClatchie, representing the Los Angeles section of the AIEE.

Officers of the Nebraska Section and the University of Nebraska Student Chapter are introduced to each other at the first joint meeting of the year. Pictured, left to right, are Nathaniel W. Beezley, secretary-treasurer of the Section; George R. Bathe, senior vice-president of the Section; Douglas D. Lewis, Section president; Peter R. Schmitt, vice-president of the Chapter; Prof. Adrian Legault, Faculty Adviser; Paul E. Cook, treasurer of the Chapter; and Prof. George C. Ernst, junior vice-president of the Section and head of the university's civil engineering department. Professor Ernst spoke on recent trends in structural analysis. There were about 70 present.

ASCE Director E. W. Carlton (left) presents the Frank L. Flynt Award to John Best, member of the Missouri School of Mines and Metallurgy Student Chapter. The award consisting of engineering reference books is made possible by funds provided by the family of Frank Leroy Flynt, an alumnus of the class of 1910. The award goes to an outstanding member of the Chapter who is finishing his junior year in civil engineering, with members of the Chapter electing the recipient by popular vote.

Scheduled ASCE Conventions

SAN DIEGO CONVENTION
San Diego, Calif.
Hotel U. S. Grant
February 6–11, 1955

ST. LOUIS CONVENTION
St. Louis, Mo.
Jefferson Hotel
June 13–17, 1955

NEW YORK CONVENTION
New York, N.Y.
Hotel Statler
October 24–28, 1955

Making quality concrete was the subject of a talk and two movies constituting the program for the **Providence Section's** October meeting. A. L. Delaney, structural field engineer for the Portland Cement Association, was the featured speaker.

Tunnel problems being explored on the Feather River Water Project were described and analyzed at the October 26 meeting of the **San Diego Section.** Max Bookman, principal hydraulic engineer for the California State Division of Water Resources, centered his talk on engineering aspects of the investigations, while Lawrance James, state geologist, commented on the geologic phases. ASCE Director M. J. Shelton reported the recent Board meeting in New York, emphasizing the benefits to be derived from the dues increase.

Since spring the **Syracuse Section** has added some three dozen new members to its rolls (many of them from the Watertown, Massena, and Potsdam area), and there was a good turnout of these members at the October meeting. William A. Haley, of the local office of the Universal Concrete Pipe Co., showed films—entitled "Lo-Hed Pipe" and "Precast Bridge Decks"—and commented on them. The Lo-Hed Pipe is a relatively new product, which is apparently competing with the conventional box culverts as well as with corruguted metal culvert pipe.

J. H. Murdough, professor and head of the civil engineering department at Texas Technological College, was elected president of the **High Plains Branch** of the **Texas Section** at the group's fall meeting at Lubbock. Other new officers elected are E. W. Rowland, of Amarillo, vice-president, and A. C. Bowden, of Lubbock, secretary-treasurer. H. H. Allen, manager of the SACROC Unit at Snyder, described his organization's work in recovering oil in the Snyder fields by water flooding. Others on the program were R. W. Tucker, assistant district highway engineer at Lubbock, and G. W. Willis, geologist for the High Plains Underground Water Conservation District. New officers of the **San Antonio Branch,** elected on September 20, are Willard E. Smith, president; R. A. Thompson, vice-president; and E. J. Brown, secretary-treasurer.

Coming Events

Cincinnati—Meeting in the Engineering Societies Building on January 5, 8 p.m. Subject for the evening is "Some Radiation Problems in Sanitary Engineering."

Delaware—Ladies night dinner and dance at the Starlight Room in the Hotel Rodney, Wilmington, December 7, 6:30 p.m.

Indiana—Annual meeting in the Rainbow Room of the Severin Hotel, Indianapolis, on the evening of December 16, will feature election of 1955 officers and an address by Past-President Terrell.

Los Angeles—Annual dinner meeting at the Rodger Young Auditorium, 936 W. Washington Boulevard, December 8, 7 p.m. Dinner reservations may be made by calling Secretary Martin Duke at Bradshaw 2-6161 by December 6. The Hydraulics Group will meet in Room 2, State Division of Highways Building, 120 South Spring St., Los Angeles.

Metropolitan—Meeting in the auditorium of the Engineering Societies Building, 33 West 39th St., December 15, 7 p.m. Junior Branch will meet in Room 502 of the Engineering Societies Building on December 15, 7 p.m., and in Room 501A on January 12, 7 p.m.

New Mexico—Fall meeting in Santa Fe, December 9–11. The ASCE Executive Committee will meet during this session. Information from Secretary-Treasurer Rufus H. Carter, Jr., 3126 12th St., N. W., Albuquerque, N. Mex.

Philadelphia—Dinner meeting at the Philadelphia Engineers' Club, January 11, 6:30 p.m.

Sacramento—Weekly luncheon meetings at the Elks Temple every Tuesday at 12 noon.

FROM THE NATION'S CAPITAL

JOSEPH H. EHLERS, M. ASCE — Field Representative ASCE

Election Results Analyzed

The return of Congress to Democratic control probably will not result in any "cold war" as the campaign speeches put it, but will more likely result in a rather "cool peace" in the relations between the executive and legislative branches—with a few preliminary skirmishes aimed at the 1956 campaign.

Any effort to discuss the bearings of political changes on the interests of a profession as represented by a completely non-political professional society is fraught with some danger. In general the immediate effects of the shift will not be very great. No mandate was given to veer off the middle-of-the-road course charted by the President. In fact the Democrats whose seniority will put them into the powerful committee chairman positions, are in many cases leaders who have no radical inclinations, and of course the President still has the veto power, which will prove decisive if used.

The Senate Finance Committee will be headed by staunch conservative Byrd. The House Rules Committee so influential in screening the legislation that is destined to reach the floor, will be headed by conservative Congressman Smith of Virginia. Appropriations Committees will be headed by Senator Hayden and Congressman Cannon, moderates but inclined to heavier spending than Congressman Taber, the previous House committee Chairman.

With reference to military expenditures, the new committee heads are advocates of heavy defense spending. Housing will be in the hands of pro-public-housing committee chairmen, who will support the original Eisenhower proposals or go beyond them in favoring public housing. Hospital construction will receive support from the new chairmen. The Eisenhower highway promotion plan will receive just as strong support from the new Congress, as it would have from the last one, with perhaps a different emphasis on some details. Any river and harbor projects that might be presented would receive strong support in committee. The attitude toward power and reclamation will incline toward more public power and other governmental ventures.

A somewhat uncertain situation exists with reference to labor laws. The AF of L is opposed to the professional provisions of the Taft-Hartley Act and may sponsor an attempt to remove them if the labor laws are to be opened up for radical revision. It is possible that the democratic leadership may feel under some obligation to AF of L. leaders for their political support. On the other hand, the chairman of the House Committee on Education and Labor would probably not support any move to sacrifice the interests of the professional engineers. It has been rumored that an attempt will be made to split this committee into two parts with the idea of putting in as chairman of the Labor Committee a person in favor of a drastic overhaul of the labor laws. Under this scheme the present chairman, a Southern Democrat, would be shifted to a proposed Committee on Education.

The Social Security legislation is a matter of interest to professional engineers. Both parties are committed to its extension. The question of exemption might be opened up by the farmers who were included recently. The Senate opposed inclusion of self-employed engineers and would again take that position under democratic leadership. However, with the law already on the books it is doubtful if it could be changed with respect to engineers in view of differing opinion within the profession.

Some pay increase for government employees will be authorized. It will be even more difficult than in the 83rd Congress to enact the type of measure ASCE supported there, namely, larger pay increases for the middle and higher brackets as opposed to a flat increase for all.

Highways

The National Highway Program based on the President's proposals (November issue, page 75), will be debated in the coming session of Congress. The committee, headed by General Clay, has not yet completed its report to the President. The report of the Governors Conference is likewise still in course of preparation. Both of these reports will reach the President in time to include the subject in his State of the Union message to the new Congress during January. The Clay committee will review some of the recommendations of the Governor's report before submitting its own report. Most areas of conflict between the two groups have been eliminated.

Meanwhile interest in the situation centers in the resignation of Francis V. duPont as Commissioner of Public Roads to become Special Assistant to the Secretary of Commerce to study the highway program. It is thus suggested that the highway proposals will involve actions beyond the present scope of the Bureau of Public Roads, possibly the setting up of a Government Loan Corporation. Mr. duPont has stated that the move is primarily to relieve him of the administrative and detail work of operating the Bureau. Deputy Commissioner C. D. Curtiss, in charge of finance and business management for the Bureau and a past-president of the District of Columbia Section of ASCE, will act as commissioner.

ASCE has established a special Board Committee on a National Highway Program under the chairmanship of Past-President Carlton Proctor. This committee is in a position to study the situation from an impartial viewpoint free of the influences which dictate the actions of the pressure groups in this field. It should make a valuable contribution to the subject before Congress finally decides on a National Highway Policy to supplement the present program of $875 million a year for the next two fiscal years.

The 40,000-mile interstate system which carries a quarter of the total highway traffic and touches 95 percent of the cities of over 50,000 population is the key to the highway program. The $175 million per year scheduled for it now, although a huge increase from previous years, is still not enough to complete it in ten years as desired by the president. Some new financing scheme or federal aid formula seems to be required.

Washington, D.C.
November 18, 1954

NEWS BRIEFS . . .

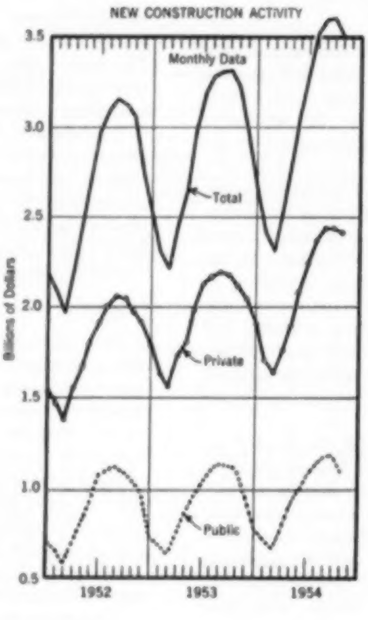
New Construction Activity at Record October High

While construction activity in October showed the slight decline usual for the month, the \$3.5 billion total for new work put in place set a record for October, according to preliminary estimates prepared jointly by the U.S. Departments of Commerce and Labor. October volume this year was 3 percent under the September figure and exceeded the October 1953 volume by 8 percent.

Most major construction categories continued strong for the time of year, with outlays for both total private and total public construction, for private residential building, churches, schools (private and public), roads, and sewer and water facilities at an all-time October high.

On a seasonally adjusted basis, construction activity in 1954 has risen almost steadily from January to October at a rate which indicates that spending on new construction will total \$37 billion by the year's end. This compares with actual outlays of \$35 $\frac{1}{4}$ billion in 1953, the previous most active construction year.

Gains in private activity account for almost the entire increase over 1953, when the first ten months of each year are compared. During the January-October 1954 period, the value of new private construction put in place totaled \$21.1 billion, 6 percent more than in the corresponding months of 1953. On the other hand, public outlays, at \$9.7 billion, were about the same this year as last, for the first ten months. Declines in federal spending were offset by increases in state and local government spending.



Indicated in Department of Commerce curves is a 3 percent seasonal decline in October construction expenditures. However, the \$3.5 billion total for new work put in place set a record for the month.

Private residential building alone accounted for over 70 percent of the dollar gain from 1953 to 1954, in the January-October period. Thus far in 1954, expenditures for new private residential building come to nearly \$11 billion—approximately half the total private outlay, and well above the total spent for all types of public construction combined.

Schools (private and public combined), commercial buildings, highways, sewer and water systems, and religious buildings also showed substantial dollar gains over last year, in the order named. Each of these construction categories, in addition to private residential building, set a new record this year for the January-October period.

Major types of construction for which 1954 activity was less than last year's total for the first ten months were military facilities, private and public industrial building, public housing, farm construction, conservation and development work, and railroad construction. Construction of other types of privately owned utilities, and of hospitals (public and private), was maintained at about the 1953 level.

The total of \$30.8 billion for all types of new construction put in place during the ten-month period was 4 percent above the comparable 1953 figure, and established a new high for the period, even after adjustment for price changes.

Bridge Across Pepacton Reservoir Nears Completion

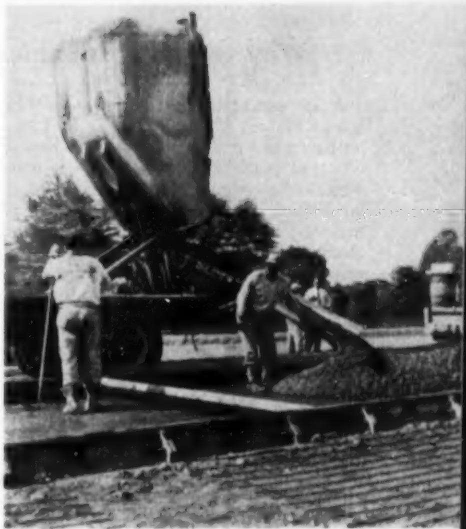
This steel deck bridge, designed by the New York Board of Water Supply, is being erected in the Catskill Mts. at Shavertown, N.Y., to carry Route 30 across the new Pepacton Reservoir. The reservoir will be formed on the East Branch of the Delaware River in the development of New York City's water supply system. The two-lane bridge, which is 120 ft high and 975 ft long between the abutments, is supported on four granite-faced concrete bents. There are three 225-ft center spans and two 150-ft end spans, consisting of a 112-ft 6-in. suspended span and a $37\frac{1}{2}$-ft. cantilever. The main girders, of silicon steel, are 13 ft deep at the piers and 9 ft deep in mid-section. Steel erection, which was completed in August, was handled by the Bethlehem Steel Co., for the Cayuga Foundation Corp., the general contractors. Total construction costs will be \$2,300,000, and completion of the project is expected by January 1.

Contract for Hampton Roads Crossing Let

Award to the Merritt-Chapman & Scott Corp., of New York, of a $19,050,461 low-bid contract for a four-mile tunnel-bridge project that will provide the first direct vehicular route across Hampton Roads is announced by the Virginia State Highway Department. The "trench-type" tunnel and two low-level approach bridges of reinforced concrete, linking Willoughby Spit (near Norfolk) on the south shore with a point near Hampton on the north shore are major features of a 23-mile Tidewater area project said to be the largest in the history of the Department. The underwater section of the tunnel will be approximately 6,860 ft long and will consist of twenty-three massive sections of double-shell steel tube casing. It will have a 23-ft, two-lane roadway and will be 113 ft below the surface at the deepest point. Man-made islands, built up by the fill method to 11 ft above mean sea level, will link the tunnel with the concrete approaches to the bridge.

The tunnel and bridges were designed by Parsons, Brinckerhoff, Hall & Macdonald, who will also be the consulting engineers during construction.

Modern Machines Speed Ohio Turnpike Work



Another new turnpike takes shape—this one across the state of Ohio. Here the gondola of a Dump-Crete truck goes high in the air as a 4-yd load of mixed concrete is poured onto prepared subgrade on Section 2. A worker (center) guides the delivery trough, and a Jaeger Finisher (to the right) is in position to work and level the mix. Dump-Crete trucks have rounded bottoms and baffles to prevent segregation of concrete in hauls of up to five miles from the central mix plant. In the foreground, welded wire fabric, style 6 × 12-0/4, is laid out on shoulders, prior to placing on the first course of the newly poured concrete. Photo courtesy Wire Reinforcement Institute.

Conveyor Belt System to Replace N.Y.C. Shuttle

Within the next three years the subway shuttle trains between Grand Central and Times Square in New York will be abolished in favor of a conveyor belt system. Work on the project will get under way soon, following award of a $3,881,000 building contract to Passenger Belt Conveyors, Inc., of Akron, the sole bidder. An additional $1,100,000 will be required for reconstruction of the tunnel.

The plan entails the use of moving loading and unloading platforms and small closely spaced passenger cars riding on an endless track of rubber conveyor belt. Passengers at either end of the shuttle will walk directly onto a 6-ft-wide loading platform operating at the rate of $1^1/_2$ mph (about half the average walking pace). Alongside the loading platform, and moving at the same speed, will be a continuous stream of small passenger cars, with seats on one side of the aisle. With cars and platform both moving at the same speed, the effect will be the same as if both were standing still when passengers enter the car. When the loaded cars reach the end of the platform, the doors will close automatically. The cars will then pass over banks of accelerator rubber-tired wheels onto the main conveyor belt, which will have speeds up to 15 mph. The unloading process will be similar but in reverse.

It is estimated that the new facility will have a peak capacity of 22,000 passengers an hour.

Radiation Exposure from Radiant Heating

ANDREW F. GABRYSH, A.M. ASCE, AND FRANCIS J. DAVIS

Oak Ridge National Laboratory, Oak Ridge, Tenn.

In "Nuclear Notes-VI," page 85 of the October issue, mention was made of possible health hazards related to the use of low-level radioactive aggregate in concrete structures for human habitation, particularly when radiant heating of floors and walls is involved. The authors here present further details of the known effects of radon on man.

The large amounts of radon, a radioactive gas, released from expanded microfissures in radium-bearing concrete aggregate, where it has built up by radioactive decay of radium, are of great concern to the health physicist and geneticist. Individuals, who spend most of their time in the increasing number of structures made of concrete containing radioactive minerals, are exposed to radon gas. This radiation exposure can be avoided by selecting aggregates from sites where the radium content of the rock has been shown by laboratory analysis to be low—that is, aggregate having an average uranium concentration of about .004 percent.

A study of radon leakage from rock samples having an average uranium concentration of about .008 percent indicates that, due to heating alone, about 4×10^{-10} curies of radon per cubic foot of air could result from a floor warmed to 137°F in a tightly closed 15 × 10 × 8-ft room. In a room located between two heated floors, the radon concentration would be approximately 8×10^{-10} curies of radon per cubic foot of air.

The total radon concentration in room air is the sum of the cold-concrete yield and the yield resulting from heating the concrete. It was found that for the samples tested, the maximum concentration for heated concrete could be about 4×10^{-9} curies of radon per cubic foot of air. This is above the accepted value of about 2.8×10^{-9} curies per cubic foot for allowable radon concentration, a figure adopted at the 1954 Harriman Tri-partite Conference on Radiation Protection.

Although it is difficult to investigate and weigh objectively general health disturbances caused by small amounts of radiation, about which knowledge is incomplete, the following conclusions seem justified.

Every precaution should be taken to prevent radiation exposure even when the radiation dose is low. It is often stated that the problem of health hazards from small radiation doses is only of academic interest, but that blood changes occur after relatively small doses of radiation is a well-known fact. More important, recent investigations by R. M. Sievert and W. Russell indicate that the genetic significance of small doses of ionizing radiation in man is of more importance than was believed earlier.

This study leads to the conclusion that the use of building material causing abnormally high ionizing radiation exposure in confined areas—material having an average uranium concentration of about .004 percent and above—should be avoided in the construction of dwellings. Thus the engineer should plan a laboratory analysis for aggregate used in schools, houses, office buildings and other concrete structures designed for human habitation in order to safeguard persons from unnecessary radiation hazards. Such radioactive materials, however, could be used safely in the construction of bridges and highways.

Why the U. S. Is Behind in Highway Construction

At the recent ASCE Convention in New York, Francis V. du Pont, U. S. Commissioner of Public Roads, clearly showed why the reduced wartime highway construction program and the soaring vehicular mileage of recent years have left our highway network so deficient. Using the charts reproduced here, the Commissioner showed that while actual dollar expenditures for highway construction in the post-World War II period have apparently soared, the dollar volume (adjusted to the 1925–1929 average levels) in these years does not greatly exceed expenditures at the 1931 and 1936 peaks (approximately $540 million in 1936 to $660 million in 1953, an increase of about 25 percent). During this time the index for vehicle miles traveled has jumped from about 73 in 1931 and about 88 in 1937 (1940 vehicle mileage equals 100) to about 183 for 1954, or an increase of over 110 percent.

From these charts it can also be seen that, with the exception of the war years with their gas rationing, the curve for vehicle miles closely parallels the curve for "Gross National Product." It can therefore be logically assumed that as the national recovery continues to expand, the number of vehicle miles traveled each year will continue to increase.

Of further significance is the low construction volume of the 1941–1945 period, which left a deficit to be made up in the postwar years. Totaling this backlog with the greatly increased vehicle milage shows the need for a greatly expanded highway construction program.

Commissioner du Pont stated that while the country has the engineering capacity to undertake such an expanded program, we do not have engineering talent to waste. He believes that many engineering organizations are using trained and experienced engineers on subprofessional work which could easily be handled by trained technicians.

Many estimates have been made as to the actual dollar volume needed to bring the nation's network of highways up to date. The latest authoritative figure comes from Gen. Lucius D. Clay, Hon. M. ASCE, chairman of President Eisenhower's Advisory Committee on the Highway Program. In a speech before the American Petroleum Institute, General Clay placed at $76,000,000,000 the figure needed to bring the nation's highways up to minimum standards for the anticipated needs of 1974. This goal is to be reached by 1964 according to present plans. The question of financing, which is the heart of the whole program, will probably be resolved on a "pay as you go" basis.

A special bond issue, amortized by federal gas and oil tax funds, is the most feasible means in sight of getting the additional funds, the general said.

Chart I. Federal aid highway construction put in place, 1924–1953.

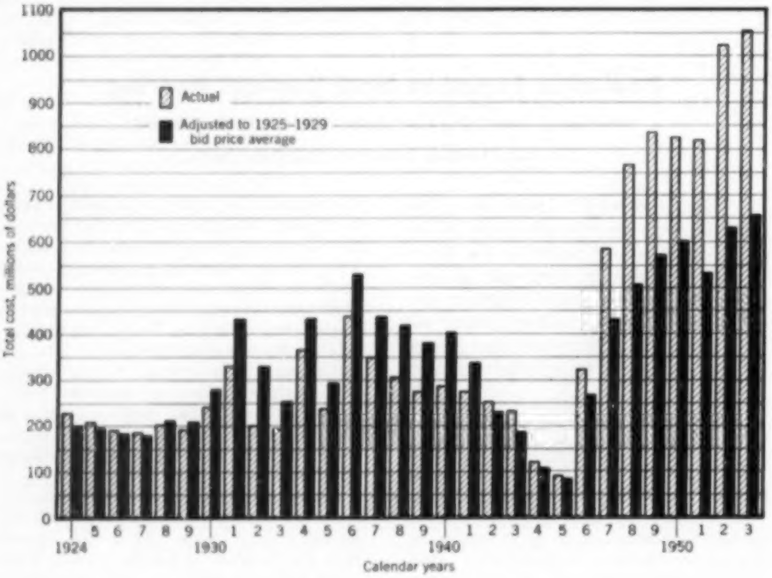
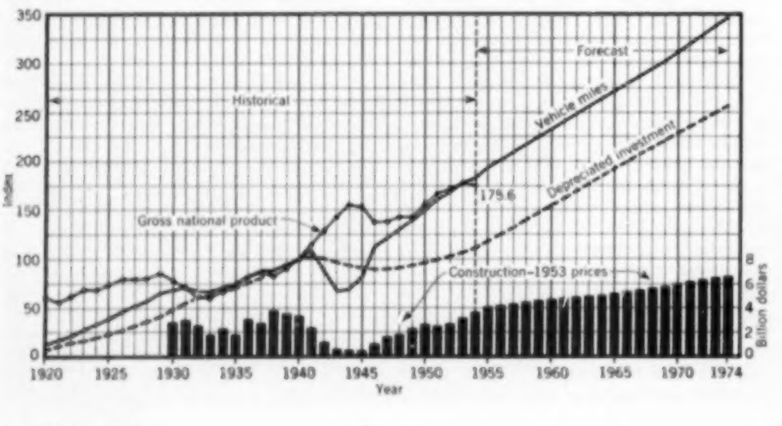


Chart II. Significant trends in highway development (index-1940-100) are shown here. Included is construction-current tax structure (capital outlay at 1953 prices).



Signal Corps to Have Station in Eritrea

An $8,000,000 cost-plus-fixed-fee contract has been awarded to Crow-Steers-Shepherd by the Corps of Engineers to build a communications station for the Signal Corps at Asmara, Eritrea, in East Africa. The joint venture trio—made up of the William L. Crow Construction Co. and J. Rich Steers, New York firms, and the Shepherd Construction Co., of Atlanta, Ga.—is just completing Wheelus Field, a huge Air Force base in Tripoli, North Africa. Construction will begin in about six weeks, with Horace A. Taylor, who has been field superintendent on the Wheelus Field Project, resident construction superintendent.

American Welding Society Elects New Officers

Joseph H. Humberstone, president of the Air Reduction Sales Co., Inc., has been elected president of the American Welding Society and took office at the organization's recent annual meeting in Chicago. Also elected were J. J. Chyle, of Milwaukee, Wis., to the office of first vice-president, and C. P. Sander, of Vernon, Calif., as second vice-president. Named as new directors at large were E. D. Peters, Decatur, Ill.; R. J. Yarrow, Cleveland, Ohio; G. O. Hoglund, New Kensington, Pa.; and J. L. Wilson, New Jersey.

Special Steel Coupling Designed for Garrison Dam Project

When the Army Corps of Engineers began construction of Garrison Dam at Riverdale, N.D. (October 1949 issue, page 28), it encountered a special problem that demanded satisfactory solution if the project was to be a complete engineering success.

Specifications called for one of the largest rolled fill earth embankments in the world. Stretching across the Missouri Valley for more than two miles, the embankment, rises 200 ft above the stream bed and contains 70,000,000 cu yd of material. With the dam located on "Fort Union" formation, the engineers found that the structure would be subject to settlement, rebound, and other shifting. This was a specially critical condition for the five 24-ft-dia steel power penstocks, for which the Corps of Engineers specified a flexible pipe coupling, or "articulating joint" to make them sufficiently flexible.

The solution to the problem was provided by R. H. Baker & Co., Inc. (Huntington Park, Calif.), who designed a special steel coupling for these pipes of unprecedented size. The coupling consists of a steel ring incorporating two resilient rubber gaskets (Fig. 1). Clamping lugs spaced $6^1/_2$ in. apart around the circumference of the pipe press the gaskets into a sealing relationship between the pipe and the coupling. These gaskets are $2^1/_2 \times {}^3/_4$ in. in section, and are partially wedge shaped. Welded to the inside of the coupling ring ($1^1/_2$ in. $\times$ 2 ft in section) are two bevel-faced anchor rings. The beveled face of the rubber-gasket ring is forced against the similarly beveled face of the anchor ring by the C-shaped cast lugs and through bolts.

Specifications required that full-sized sections of the penstock be tested in conjunction with the coupling. The Corps of Engineers asked that the pipe and coupling be tested at 150-psi water pressure for expansion and contraction, articulation and offset between the pipes, in such a manner as to duplicate actual penstock conditions.

Production of a full-scale prototype was authorized and completed early in 1954. Before the Corps of Engineers gave its final approval to the newly designed coupling, however, exhaustive tests were required to provide conclusive evidence of trouble-free operation.

Testing the prototype coupling, was, in itelf, a project of sizable proportions and required some $40,000 worth of special apparatus. (See Fig. 1.)

The test device consisted essentially of two short lengths of steel pipe, 24 ft 3 in. O.D. by 1 in. thick, representing the ends of the penstock sections being coupled, and a smaller-diameter inner steel pipe or sleeve on which these were mounted. To facilitate test handling, the inner sleeve was set up with its longitudinal axis in a vertical position, and was made somewhat longer than the combined length of the 24-ft 3-in. O.D. pipe-end sections. The lower pipe-end section was welded water tight to the inner sleeve, while movement of the upper pipe-end section was allowed for by a rubber seal between it and the inner sleeve. This seal or gasket permitted the upper pipe-end section to slide or slip in the longitudinal direction with respect to the sleeve and the fixed lower pipe.

Flexing movement was produced by 84 hydraulic cylinders attached between the inner sleeve and the upper pipe section and equally spaced around their upper periphery.

In the first stage of the test, the upper pipe section was moved back and forth $1^1/_2$

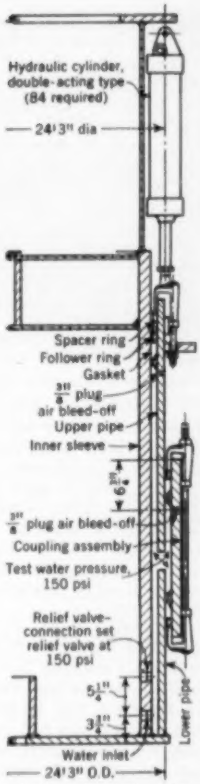
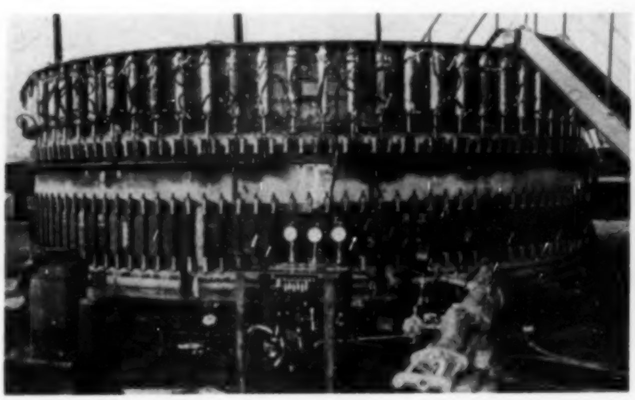


FIG. 1. Details of coupling assembly are here shown together with the test set-up to assure watertightness under 150-psi pressure and angular movement of joint.

Flexible joint devised for 24-ft-dia penstocks of Garrison Dam is being tested for watertightness under 150-psi pressure (lower left photo). C-bolts around the lower half of the test set-up wedge rubber gaskets of joint while the 48 double-acting hydraulic cylinders around the top moved the upper pipe section to simulate probable shifting of the penstock. As shown in the right-hand photo, a coupling, stiffened with a spider, is being slipped over the end of a penstock pipe section. Sections are trucked to tunnel and mated to the section in place.



in. in relation to the lower pipe section, while water under a pressure of 150 psi was introduced into the annular space between the coupled end sections and the inner sleeve. For the second stage of the test, half the hydraulic cylinders were compressed while the other half were extended to produce an angular misalignment of some 39 min between the axes of the two pipe-end sections under full water pressure.

Repeated flexing cycles under varying pressures were recorded over a four-day test period with no indication of fracture or leakage of the giant coupling.

The joints are now being installed at Garrison Dam where the first penstock is expected to be producing power early in 1955. The prime contractor for furnishing and installing the penstocks and couplings is the Southwest Welding and Manufacturing Co. The installed price of the 45 couplings required is approximately $4,000 each. Mating the sections of these big penstocks in a concrete-lined tunnel only a little over 1 ft larger than the outside diameter of the pipe is a ticklish job.

For the Garrison District of the Corps of Engineers, Col. Henry L. Hille, Jr., is district engineer. Richard D. Field, M. ASCE, chief of the Design Branch, observed the tests for the District office. The coupling design and the test device were developed by Edward H. Schustack, general manager of R. H. Baker & Co., who handled the test and also furnished the information contained in this article.

ASCE Labor Statement Endorsed by EJC

The ASCE stand on collective bargaining for professional persons, was endorsed by the Full Board of the Associated General Contractors at its St. Louis meeting in September. This policy statement follows:

"1. Any group of professional employees, who have a community of interest and who wish to bargain collectively should be guaranteed the right to form and administer their own bargaining unit and be permitted free choice of their representatives to negotiate with their employer.

"2. No professional employee, or group of employees, desiring to undertake collective bargaining with an employer should be forced to affiliate with, or become members of, any bargaining group which includes nonprofessional employees, or submit to representation by such a group or its designated agents.

"3. No professional employee should be forced, against his desires, to join any organizations as a condition of his employment, or to sacrifice his right to individual personal relations with his employer in matters of employment conditions."

VMI Host to Large Virginia Road Conference

With "Modern Highways—the Key to Progress" the program theme, the eighth annual Virginia Highway Conference, held at Virginia Military Institute, October 6–8, attracted the record attendance of over 700. Now a well-established fixture in the Old Dominion, these yearly meetings are sponsored jointly by the Virginia Department of Highways, VMI, and fourteen other cooperating agencies. The program featured a number of national and state authorities on highway planning and construction and a series of discussion panels manned by experts. There was also a half-million-dollar exhibit of road-building and maintenance equipment and extensive displays of safety facilities.

Coming in for special attention throughout the three-day program was the toll method of financing major highways and the need for more arterial routes. The governor of the state, Thomas B. Stanley, featured speaker at the closing session, forecast the possible extension of the eastern Virginia turnpike to the northern and southern borders of the state. "It is agreed among highway authorities," Governor Stanley told the conference, "that toll roads can only be justified in sectors of heavy traffic density, where other thoroughfares are inadequate and where, for budgetary reasons or otherwise, it is impracticable to construct additional freeways. It is apparent, therefore, that toll roads can provide a very limited form of relief to us in Virginia. However, Virginia is in the nature of a bridge for motor traffic moving along the eastern seaboard, and through traffic constitutes a high percentage of the total volume moving over a number of our north-south highways. Governor Stanley also called again for the withdrawal of the federal government from taxing gasoline.

Virginia State Highway Commissioner James A. Anderson, M. ASCE, greets two of the important speakers at the VMI Highway Conference. Shown, left to right, are Mr. Anderson, General Hayford, and Governor Stanley.

Sharing the platform with the governor on the final day of the conference was Maj. Gen. Bertram F. Hayford, deputy chief of transportation for the Army. General Hayford told the conference that the construction of more limited-access arterial highways is essential to both national defense and peacetime progress. He noted that the interstate highway system, which has been designated the principal road network to serve national defense, has a total length of approximately 40,000 miles and serves 90 percent of the nation's cities with populations in excess of 50,000, plus many smaller communities. While it is recognized that all highways are potentially valuable for national defense, General Hayford said "the major arterial highways will be required to carry the priority and large-volume traffic, and these are the most deficient."

Alfred E. Johnson, M. ASCE, Arkansas state highway commissioner and president of the American Association of State Highway Officials, presented the view that the states should not go overboard in developing toll roads as a solution to highway problems. "The toll method of financing improvements must be considered only as one way of paying for roads, and in many ways it is the most expensive way," Mr. Johnson declared. In another major talk, Francis V. duPont, U. S. Commissioner of Public Roads, said that there is a regrettable lack of understanding of the nation's highway deficiencies, and emphasized the need for getting "the proper perspective on the problem we are trying to solve."

The Virginia State Highway Commission met during the course of the conference and authorized the sale of $100,000,000 of toll revenue bonds, which will be used to finance construction of the Hampton Roads bridge-tunnel system (item elsewhere in this department) and a new Rappahannock River bridge, and to refinance bonds outstanding from a 1949 issue.

Some of the half-million-dollar exhibit of road-building and maintenance equipment on display on the VMI campus during the conference is shown here.

Engineers' Salary Situation Studied by Idaho P.E. Society

A stand on the engineers' salary situation was taken by the Idaho Society of Professional Engineers at a recent statewide meeting in Pocatello, when it accepted a report of its Salary Study Committee. In accepting the report of the committee, the ISPE went on record as (1) recognizing the salary situation as a contributing cause of unsatisfactory professional conditions, (2) authorizing a program of action to get salaries raised, and (3) disapproving professional unions and bargaining groups.

Stating that "In general the salaries of professional engineering employees are lower than is consistent with the training and ability required, and the responsibility and economic values involved in their work," the committee expressed the conviction that the ISPE can help improve existing conditions by:

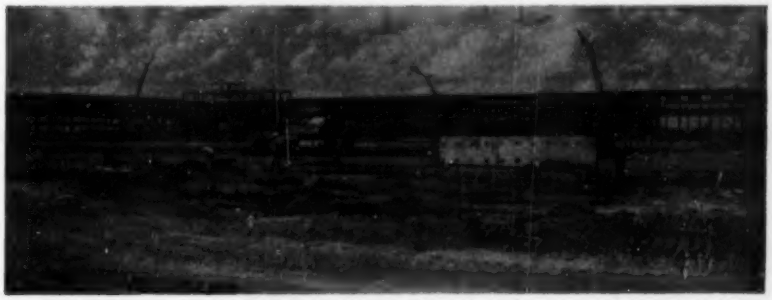
1. Providing management and all engineering employers with unbiased factual information on salary needs and conditions
2. Encouraging frank open discussion of salaries and economic problems between engineering employers and employees
3. Providing employers with information on the economic value and other advantages of good engineering services
4. Encouraging salaried engineers to place a higher value on their services and to try to get salaries consistent with such value
5. Studying and recommending ways of providing small governmental units and the public with good engineering services
6. Doing everything possible to maintain high professional and ethical standards among all professional engineers.

G. A. Riedesel, A. M. ASCE, of Moscow, president of the ISPE, served as chairman of the Salary Study Committee, which also included James Martin, of Moscow; Orland Mayer, of Boise; James Morris, of Boise; W. P. Hughes, M. ASCE, of Boise; C. C. Hallvik, A. M. ASCE, of Boise; and Jay Painter, of Idaho Falls.

L. B. Foster Co. to Distribute Taylor-Forge Foundation Pipe

L. B. Foster Co., one of the nation's largest suppliers of steel sheet piling, rails, track accessories, and pipe, has been appointed exclusive national distributor of Taylor-Forge spiral weld foundation pipe. The pipe, which conforms to ASTM Specification A-252, Grade 2, for pipe piling, comes in a wide variety of lengths and wall thicknesses.

Caterpillar Tractor Builds New Plant at Decatur, Ill.



A new 855,000-sq ft manufacturing plant and office building is being built by the Caterpillar Tractor Co. on a 423-acre site at Decatur, Ill. The project is part of a $45,000,000 expansion program that will provide for manufacture of industrial wheel tractors and motor graders at Decatur and a broadened program of crawler and diesel engine production at Peoria. By September, much of the concrete had been poured at the Decatur plant and 30 percent of the structural steel erected. Full-scale production is expected by the spring of 1956.

Winners of 1955 Moles Awards Named

Thomas J. Walsh, board chairman of the Walsh Construction Co., and Carl B. Jansen, M. ASCE, president of the Dravo Corp., of Pittsburgh, have been named the 1955 member and non-member recipients of the awards given annually by the Moles for "outstanding achievement in construction." The announcement was made at a recent dinner meeting of the organization, a New York society of leaders in the tunneling and heavy construction industry. When the awards are presented—at a banquet at the Waldorf-Astoria on February 2—the two winners will be the fifteenth pair honored in a series that started in 1941 and numbers among its recipients former President Herbert Hoover, Robert Moses, Admiral Ben Moreell, and Gen. Brehon B. Somervell.

Mr. Walsh has been chairman of the board of the Walsh Construction Co. since 1946, when he retired as president of the organization after thirty years of service in the post. His firm has driven some of the country's most notable tunnels, and was one of the contractors constructing the Grand Coulee Dam and the U. N. secretariat building. Connected with the Dravo Corp. during his whole career and president since 1946, Mr. Jansen has been in charge of many large projects, including the substructures for the East Bay crossing of the San Francisco Bay Bridge, the Philadelphia subways, and a section of the Delaware River Aqueduct.

Thomas J. Walsh **Carl B. Jansen**

Illinois Authorizes Toll Road Studies

Engineering plans for the Illinois toll highway system are being prepared by Joseph K. Knoerle & Associates, Inc., Wilber Smith & Associates, and Parsons, Brinckerhoff, Hall & Macdonald, Inc., according to an announcement from Evan Howell, chairman of the Illinois State Toll Highway Commission. The route under study would extend from the Indiana border to the Wisconsin line, skirting Chicago and providing a spur in a northwestern direction to Wisconsin via Rockford, an east-west spur toward the cities of Rock Island and Moline, and a thruway connecting East St. Louis with Indiana in the vicinity of Terre Haute.

This system would provide a through route for those wishing to bypass Chicago, while the spurs will offer radial service to the heart of the city through connections with City of Chicago expressways now under construction over Congress Street and the Northwest Expressway.

Construction Pushed on Unique Chicago Skyscraper Project

New Mid-America Home Office of the Prudential Insurance Co., under construction in Chicago, straddles Illinois Central and Michigan Central tracks. Sloping steel framework in foreground will support extension of East Lake Street, which will connect with Stetson Avenue, being constructed to the east (left) of the building. Randolph Drive may be seen in the background, to left of the structure. Welded wire fabric, style 4×4-12/12, is being used in the floor construction of the 41-story skyscraper, to reinforce the concrete against shrinkage and temperature stresses. Naess & Murphy, of Chicago, is the architect-engineer on the project, and the George A. Fuller Co., of New York, the general contractor. Photo courtesy Wire Reinforcement Institute.

Engineers Needed in PHS Reserve Corps

More sanitary engineers are needed in the U.S. Public Health Service's commissioned inactive Reserve Corps, which for more than forty years has played an essential role in PHS operations. The Federal Civil Defense Administration has now delegated to the Service responsibility for federal activities required in developing a new national civil defense public health program, which has been set up to meet the threat to public health created by the advent of nuclear weapons and other special weapons such as biological warfare agents.

Next to emergency casualty care, emergency sanitary engineering operations may be the most significant factor in making it possible for the surviving population to continue to survive, the Service notes. The target for the total strength of the engineer component of the Reserve Corps is 1,000. Further information may be obtained from H. D. Hollis, chief engineer, Public Health Service, Department of Health, Education and Welfare, Washington 25, D.C., or from any of the PHS regional engineer offices.

Caterpillar Steps Up Power Of New Standard Models

Greater horsepower and faster engine speeds for its D6, D4 and D2 tractors are announced by the Caterpillar Tractor Co., Peoria, Ill. This will mean a higher rate of production for owners and more profitable operation, according to the company. Drawbar horsepower of the D6 has been increased from 66 to 75, and rpm from 1,400 to 1,600; drawbar horsepower of the D4, from 43 to 48 and rpm from 1,400 to 1,600; and drawbar horsepower of the D2 from 35 to 38 and rpm from 1,525 to 1,650.

Nuclear Notes

VIII—Neutron Reactions and Fission

"Nuclear Notes" are prepared for the Sanitary Engineering Division by its Committee on Sanitary Engineering Aspects of Nuclear Energy. Conrad P. Straub, of the Oak Ridge National Laboratory, heads the committee, which also includes S. T. Barker, A. E. Gorman, Prof. Warren J. Kaufman, and James G. Terrill, Jr. Next month's subject will be: "Methods of Measuring Radioactivity."

The neutron is a fundamental particle with a mass similar to that of the proton (1.67474×10^{-24} gram or 1.008982 atomic mass units), but which differs from the particles already considered in that it carries no charge. Because of this characteristic, Chadwick, who discovered it in 1932, gave it the name neutron. Its discovery, along with that of nuclear fission at a later date, paved the way for the development of the atomic bomb of World War II, and thus is responsible in part for the current interest in the use of nuclear energy as a source of commercial power.

The neutron is responsible for the conversion of the proton (${}_1H^1$) to deuterium (${}_1H^2$—heavy water) and to tritium (${}_1H^3$) as a result of n, γ and 2n, gamma reactions, respectively. It will be noted that the only change taking place in the hydrogen atom is in the A values which represent the sum of the neutrons and protons in the nucleus of the atom. In all cases Z, the atomic number, is 1, and we find one extra neutron in the ${}_1H^2$ atom, and two extra neutrons in the ${}_1H^3$ atom. Thus, the number of neutrons in the nucleus serves as a basis for differentiating the various isotopes of an atom.

Chadwick discovered the neutron during his experimental studies of the action of alpha-particles from naturally occurring radioactive materials on light metals, in this case beryllium. Other investigators had indicated that a gamma photon and a carbon-13 atom resulted from this reaction. However, the study of recoil tracks and energy and momentum considerations showed that the particles involved had to be relatively large, about the size of the proton. Chadwick suggested that another particle was involved, which he called the neutron, and the above reaction was then defined correctly as

$${}_4Be^9 + {}_2He^4 \rightarrow {}_6C^{12} + {}_0n^1 \text{ or } Be^9\ (\alpha,n)\ C^{12}.$$

Carrying no charge the neutron feels no repulsive force, which makes it an excellent particle for promoting nuclear reactions. As indicated in an earlier discussion, the probability of any reaction taking place is a function of the cross section of the particular isotope and energy of the neutron. In other words, there is a certain probability (called cross-section) that a certain reaction will take place at a given energy for a given atom.

In the past most neutrons were obtained from the action of alpha-particles on the lighter elements as shown by the reaction above. One disadvantage of such sources of neutrons is that the energy spectrum is rather narrow, hence the number and kinds of reactions that could be demonstrated is limited. With the development of nuclear reactors and accelerators, neutrons of varying energy became available for study.

Some neutron reactions are

$${}_7N^{14} + {}_0n^1 \rightarrow {}_6C^{14} + {}_1H^1 \text{ or } N^{14}(n,p)\ C^{14} \text{ (Capture)}$$

$${}_1H^1 + {}_0n^1 \rightarrow {}_1H^2 + \gamma \text{ or } H^1\ (n,\gamma)\ H^2 \text{ (Capture).}$$

The reactions above involve elements at the low end of the periodic table. Under proper conditions, neutrons will also react with atoms of the heavy elements. For example,

$${}_{92}U^{238} + {}_0n^1 \rightarrow {}_{92}U^{239} \xrightarrow[\beta^-]{} {}_{93}Np^{239} \xrightarrow[\beta^-]{} {}_{94}Pu^{239}$$ (Capture followed by Beta decay)

$${}_{92}U^{235} + {}_0n^1 \rightarrow ({}_{92}U^{236}) \rightarrow {}_{Z_1}X^{A_1} + {}_{Z_2}Y^{A_2} + (1 \text{ to } 3)\,{}_0n^1 \text{ (Capture followed by fission)}$$

The latter equation illustrates fission. The fission products, X and Y, are not of equal mass nor are they the same elements in every reaction. Experiments show that the fission process is asymmetrical and fission products are produced that may be classed in a light and a heavy group. Fission yield expresses the percentage of fissions that lead to the formation of a specific fission product. Since each fission produces two fission products, it is customary to speak, in general, of the total fission yield as 200 percent. A double humped curve is characteristic of thermal fission yields when plotted against atomic mass numbers. The fission products that result may include elements from germanium to about tin in the light group and from tin through europium in the heavy group.

The main sources of neutrons are reaction with beryllium (reactions of the alpha, n type), nuclear reactors, and accelerators. Radium-beryllium sources are particularly useful where mobile sources are needed. However, the range of energy obtainable is limited. In the case of the reactor or pile, it is possible to get reactions with neutrons from the fast (about 2 to 3 Mev) to the thermal (< 0.025 ev) range. Accelerators are used to provide very high energy neutron beams.

The actions of neutrons, as well as gamma photons, are of interest to the engineer since bombardment of materials by these agents causes marked changes in structure that may materially affect their chemical and physical properties. Another distinguishing characteristic of neutrons is that they are stopped or shielded out by materials high in hydrogen content, namely water, paraffin, and concrete. Heavy materials such as lead and/or admixtures of iron and concrete, which are most effective shielding materials for gamma absorption, are used with the neutron shield to stop the secondary proton recoil particles and photons resulting from the capture of the neutron by the hydrogen nucleus.

Neutrons also provide a useful tool for the analysis of trace elements or impurities in materials. Here, by a process called "activation analysis," the sample in question is placed in the reactor along with a sample of known composition, and the two are irradiated for a period of time and analyzed following withdrawal from the reactor. Through the proper control of conditions, it is possible to demonstrate the presence of minute concentrations of trace substances (down to about 10^{-8} grams).

This brief discussion of the neutron can only point to the importance of this particle in the nuclear energy program. To learn more about it reference should be made to standard texts on nuclear physics.

Suggested outside reading

1. *Nuclear Radiation Physics* (Chapters 12, 13, and 14), by R. E. Lapp and H. L. Andrews. Prentice-Hall, Inc., New York, N.Y. Second Edition (1954).

2. *The "Particles" of Modern Physics*, (Chapters 10 and 11) by J. D. Stranathan. The Blakiston Co., Philadelphia, Pa. (1945).

3. *Sourcebook on Atomic Energy*, (Chapters XI, XIII, and XIV) by Samuel Glasstone. D. Van Nostrand, Inc., New York, N.Y. (1950).

N*G*Neare's COLUMN

R. ROBINSON ROWE, M. ASCE

"I wonder," wondered the Professor timorously, "if anyone liked the problem of the floating wedge. Anyone like Joe Kerr, for instance."

"I did and I didn't," admitted Joe warily.

"He means," guessed Cal Klater, "he liked it when he started to work it and hated it when he gave up."

"No, I stopped liking it when it made me buy a book; it cost me \$3.36. You see, you said the wedge was isosceles in section, with one base corner 4 in. above and the other 12 in. below the water surface, ruling out symmetrical positions with the vertex straight up or down. So I guessed the vertex was awash and tried for a graphical solution, but every trial was 75 percent sunk instead of the 60 percent specified. That's when I bought the book!"

"And the book said?"

"It said that the density of a triangular prism with ordinates a, b and $-c$ for the edges was

$$d = c^2/(a+c)(b+c) \quad \ldots \quad (1)$$

whence, with $b = 4$, $c = 12$ and $d = 0.6$, I found $a = 3$. So the vertex wasn't awash, but 3 in. above the water."

"A nice start," conceded Cal. "But only a small start."

"That's what I found out, but I hadn't had \$3.36 worth yet, so I kept going. There are simply millions of isosceles triangles with ordinates 3, 4 and -12, but the book gave another clue: the prism will rotate unless and until its centroid is directly above the centroid of the submerged part, the center of buoyancy."

"That's where I come in," began Cal, "I . . ."

"Not yet. The book also said the coordinates of a centroid of a triangle were means of the coordinates of the vertices. So I let the abscissae of a and c be 0 and x and figured that of b to be $\sqrt{224 + x^2}$ to make the triangle isosceles. Then the mean of the three abscissae was the abscissa of the centroid,

$$x_0 = \frac{1}{3}\left(x + \sqrt{224 + x^2}\right) \quad \ldots \quad (2)$$

"Then, by simple proportion, I found the abscissae of D and E at the water line and a new mean for the center of buoyancy,

$$x_f = \frac{1}{3}\left[x + \frac{x}{5} + \frac{1}{4}\left(x + 3\sqrt{224 + x^2}\right)\right] \quad \ldots \quad (3)$$

"Obviously if the two centroids are on the same vertical, their abscissae are equal; equating (2) and (3), I found $x = 10$, and A, B and C are located at (0, 3), (18, 4) and (10, -12). The book had a formula for area of a triangle in terms of these coordinates, giving $A = 140$ in². So finally, with sea water weighing 64 lb per ft³,

$$W = \frac{140}{144} \cdot 3 \cdot 0.6 \cdot 64 = 112 \text{ lb"}$$

"Why that's right," said Cal. "It's precisely right. What's the name of the book?"

"I won't tell, but I'll sell it for \$3.37"

"You'd better keep it for the sequel," warned the Professor. "Suppose the isosceles wedge was still 3 ft long, the two equal sides were 18 in. and the base was an integer. Then suppose it was shifted by waves so that the vertex was sometimes straight up, sometimes straight down and sometimes just awash. Then suppose I ask again what it weighed."

[*Cal Klaters who checked Joe Kerr by seven different methods were: Richard Jenney, Stoop (John L.) Nagle, Rudolph W. Meyer, Clarence D. Bowser, Ed C. Holt Jr., Sauer Doe (Marvin Larson) and S. L. Dum (Thomas Borman).*]

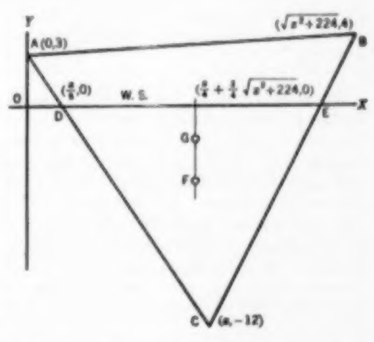


FIG. 1. Joe Kerr used "the book" to plumb *F* under *G*, equating mean abscissae of A, B, C with same for *C, D, E* to find *x* = 10.

DECEASED

Otto William Julius Anschuetz (M. '42), age 65, chief engineer of the Kansas City Bridge Co., Kansas City, Mo., died in that city on September 19. A 1910 graduate of Washington University, Mr. Anschuetz began his career with the Missouri Valley Bridge and Iron Co. at Leavenworth, Kans. Later he worked for the Union Bridge and Construction Co., and in 1936 became associated with the Kansas City Bridge Co. In 1944 he served as president of the Kansas City Section.

Charles Joseph Bartholet (M. '31), age 70, for the past 25 years supervisor of the Division of Water Resources, Department of Conservation and Development, Olympia, Wash., died on June 23. Mr. Bartholet had been in the state government service since 1914, as resident engineer on state highway construction, engineer for the Public Service Commission, assistant state hydraulics engineer, and state supervisor of hydraulics.

Frank Williamson Blair (M. '45), age 59, vice-president and construction engineer of the Nashville Bridge Co., Nashville, Tenn., died in that city on July 20. Mr. Blair joined the firm in 1919 as a draftsman and in 1922 became vice-president. He was a veteran of World War I and had attended Vanderbilt University.

Lorin Theodore Blodget (A.M. '32), age 53, since 1943 civil engineer for the Transportation and Navigation Branch of the Tennessee Valley Authority, died at his home in Knoxville, on August 17. A civil engineering graduate of Princeton University, class of 1922, Mr. Blodget had been employed by John McShain, Inc., the Pennsylvania Railroad and the New York, New Haven, and Hartford Railroad.

Prescott Jones Clapp (M. '48), age 70, senior section engineer for the New York Board of Water Supply at Ellenville, N.Y., died on March 22. Continuously connected with the Board since 1906, Mr. Clapp worked on the Catskill and Delaware Water Supply projects in the capacity of assistant engineer and civil engineer.

Thomas Hamilton Coe (M. '11), age 78, building contractor and civil engineer of Providence, R.I., died in that city on September 24. From 1915 to 1932 Mr. Coe was a partner in the firm of O.D. Purington Co., of Providence. He was president of the organization from 1932 to 1940, and later was with Jenks & Ballou, Charles A. Maguire & Associates, and the City of Providence. He was an alumnus of Worcester Polytechnic Institute, class of 1896.

James Lee Darnell (M. '10), age 82, vice-president of the Rite-Way Products Co., of Memphis, Tenn., died on August 21. Before joining the firm in 1944 as general manager Mr. Darnell had practiced as a consulting engineer in Cleveland, Ga., New York City, and Kansas City, Mo., for almost 35 years. He studied at Indiana University.

James Douglas Bullington (A.M. '46), age 52, county engineer for the Chilton County (Alabama) Road Department, died on July 30. Engaged in highway work during his entire career, Mr. Bullington was with the Alabama State Highway Department from 1925 to 1926 and from 1927 to 1946, and in recent years with the Lauderdale and Chilton county highway departments.

John Stirling Gena (M. '40), age 66, chief engineer of the Muskingum Watershed Conservancy District for the past eleven years and member of the district staff for 21 years, died in New Philadelphia, Ohio, on September 25. Mr. Gena had previously been with the General Motors Radio Corp., Dayton, and the Miami Conservancy District at Dayton, and was the designer of and engineer for the Pymatuning Dam on the Ohio-Pennsylvania line.

Samuel De Grazia, Jr. (A.M. '47), age 45, vice-president of the Segreti Construction Co., Washington, D.C., died on March 8. In 1936, following studies at Carnegie Institute of Technology, Mr. De Grazia became connected with the Chas. H. Tompkins Co., of Washington. Except for a two-year period of service in the Navy during World War II, he remained with the organization until 1948, leaving to become general manager of the Segreti firm.

Osborne Joel Dempster (M. '12), age 80, who had been practicing as a civil engineer at Hornell, N.Y., since his retirement from the New York State service in 1936, died in that city on September 25. Mr. Dempster was city engineer for Little Falls, N.Y., from 1907 to 1915. He worked for the state on highway design and construction from 1896 to 1907 and from 1915 to 1926, and as district engineer for the Department of Public Works from 1926 to 1936. He studied at Union College.

Paul Spier Egbert (A.M. '25), age 59, Major, U.S. Army, and chief of the Civil Engineering Section, Air Installations, Strategic Air Command, at Offutt Air Force Base, Omaha, Nebr., died on October 13. Major Egbert had been assistant city engineer of Mitchell, S.D., and city engineer of Aberdeen, S.D., designer for the South Dakota Highway Commission, and county highway and resident engineer for Brown County, South Dakota. He was a graduate of the University of Wisconsin.

Alva Eugene Eidson (A.M. '46), age 55, civil engineer of Merriam, Kans., died on April 16. Mr. Eidson had been connected with Nelson, Beggs & Eidson, of Kansas City, Mo., since 1946. Earlier he was with several other Kansas City firms, including Howard, Needles, Tammen & Bergendoff, the Kansas City Structural Steel Co., and the Fluor Corp.

B. A. Etcheverry, Former Director, Dies

Bernard Alfred Etcheverry (M. '24), age 73, professor emeritus at the University of California and internationally known irrigation engineer of Berkeley, Calif., died in New Haven, Conn., on October 26. Professor Etcheverry, a past-president of the San Francisco Section, former secretary of the Society's Irrigation Division and ASCE Director from 1934 to 1936, had come East to attend the 1954 Annual Convention. After graduation from the University of California in 1902, Professor Etcheverry joined the staff there, heading the department of irrigation engineering from 1905 until his retirement in 1951. He had been a consultant on the Central Valley Project and to such agencies as the Orange and Los Angeles County Flood districts, the Kern River Water Storage District, and the Sacramento-San Joaquin Drainage District.

B. A. Etcheverry

Charles Thurston Fisher (M. '21), since 1935 highway and supervising engineer for the U.S. Bureau of Public Roads, Albany, N.Y., died on July 26. Engaged in highway engineering during his entire career, Mr. Fisher was with the New York State Highway Department from 1906 to 1920 and from 1922 to 1927. He was also connected with the Morgan Engineering Co., Memphis, Tenn., and the Owen P. Williams Construction Co., Inc., Oneonta, N.Y., on highway and bridge construction. He graduated from Worcester Polytechnic Institute in 1901.

Theodore Green (M. '16), age 71, president of the Hydro Construction Co., contracting engineers of Buffalo, N.Y., died in August 1953. Mr. Green had been associated with the firm since 1914 as vice-president, chief engineer and president. Previously (1906–1914) he was employed as designing engineer, manager, and chief engineer of the Cincinnati and Chicago branch offices of the Ferro Concrete Construction Co. Mr. Green graduated from the Massachusetts Institute of Technology.

George Augustus Jessop (M. '53), age 71, consulting engineer for the S. Morgan Smith Co., York, Pa., was killed in an automobile accident on September 24. Mr. Jessop joined the S. Morgan Smith Co. in 1901 and became chief engineer in 1923, a post he held until his retirement in 1949. He received a mechanical engineering degree from the University of Michigan in 1909.


G. A. Jessop

Raymond Malcolm Kimmel (A.M. '49), age 39, senior engineer in the Texas Company's plant at Lawrenceville, Ill., died in that city on September 2. After graduating from Purdue University in 1938, Mr. Kimmel became connected with the Texas Co., as an engineer in its Port Arthur, Tex., plant, transferring to the Lawrenceville plant in 1944.

Walter McCulloh (M. '93), age 91, retired engineer of Niagara Falls, N.Y., died at his home there on October 15. Mr. McCulloh maintained a private engineering practice in Niagara Falls from 1912 until his retirement in 1934. Earlier he worked for the West Shore Railroad; for New York City on the Croton Aqueduct; the Niagara Falls Power Co.; and the National Construction Co. He attended the Columbia University School of Mines. Joining ASCE as a Junior Member in 1888, Mr. McCulloh was the Society's oldest member in point of affiliation.

Lacy Moore (M. '25), age 67, engineer of construction for the Southern Railway System, at Washington, D.C., died there on October 15. Mr. Moore became connected with the line in 1906, and in 1935 was named to the post he held at the time of his death. During World War II he handled camp construction for the Department of Defense. Mr. Moore was an alumnus of North Carolina State College.

Edward Haynes Sargent (M. '24), age 69, who retired as chief engineer of the Hudson River Regulating District of the State of New York in March, after 31 years of service, died in Albany on October 9. During his career Mr. Sargent was in charge of the design and construction of the Conklingville Dam and Sacandaga Reservoir, and served as consultant on numerous hydraulic projects including the TVA. He was a member of the Task Committee on Flood Control and Flow Retardation of the National Water Policy Panel. He was an alumnus of MIT, class of 1907.

Wilbur Cyrus Sawyer (A.M. '05), age 77, retired engineer of Los Angeles, Calif., died in that city on August 13. For thirty years (1910–1940) Mr. Sawyer was in the Los Angeles city engineer's office, serving as draftsman, civil engineer, and assistant engineer. Earlier he had been with the U.S. Geological Survey and the Bureau of Reclamation. He graduated from the University of Vermont in 1900.

Henry Atterbury Smith (M. '22), age 81, New York City architect, died on September 3. Mr. Smith had maintained a private architectural practice since 1898, specializing in residential and industrial building. He was a graduate of the Columbia University School of Mines, class of 1893.

Harold Sprenger (M. '47), age 65, road commissioner of Orange County, California, died at his home in Santa Ana on September 10. Mr. Sprenger had been bridge engineer and assistant superintendent of highways for the county since 1935. Previously he was office engineer for the City of Newport Beach, Calif., and office engineer for Edward M. Lynch and the Williams Engineering Co., both of Los Angeles. Active in the Los Angeles Section, Mr. Sprenger was the first president of its Orange County Branch. He was educated at the Stafford Technical Institute, Staffordshire, England.


Harold Sprenger

Howard Edwards Robbins (A.M. '36), age 58, regional director for Region 5 of the Bureau of Reclamation at Amarillo, Tex., died in Rochester, Minn., on September 12. With the exception of four years (1925–1929) of private employment with the California-Oregon Power Co., Mr. Robbins' entire career was spent with the Bureau of Reclamation. He joined the Bureau in 1916, at Grand Junction, Colo., and held assignments throughout the West. He was named to the Amarillo post in 1948. He attended Colorado College.

John Leonard Vogel (M. '19), age 70, for the past 29 years, bridge engineer and engineer of structures for the Delaware, Lackawanna & Western Railroad at Manasquan, N.J., died on September 28. Prior to his association with the railroad, Mr. Vogel had been a bridge engineer for the New Jersey State Highway Department and the Board of Public Utility Commission, and the Jersey Central Railroad. He studied at Cooper Union.

Leonard Oliver Williams, Jr. (M. '47), age 53, since 1947 director of the Division of Environmental Sanitation, of the Wyoming State Department of Public Health, at Cheyenne, died in that city on October 12. Earlier he was with the Missouri State Board of Health and the West Palm Beach (Fla.) Water Co. Mr. Williams was president of the Wyoming Section in 1948, and had been chairman and national director of the American Water Works Association, president of the Rocky Mountain Sewage Works Association, and director of the National Federation of Sewage Works Associations. He was a veteran of World War II and a graduate of the Missouri School of Mines.

RECENT BOOKS

Principles of Engineering Thermodynamics

This textbook of fundamentals, by Paul J. Kiefer, Gilbert Ford Kinney and Milton C. Stuart, intended for use in undergraduate and graduate courses, stresses both ideal capabilities and inherent limitations of power-plant and similar equipment. The text has been completely revised and a number of additions have been made. These include a dynamic equation developed from force considerations for the analysis of high-velocity flow phenomena, and a means for accounting for variation of specific heats of gases with temperature. (John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y., second edition, 1954. 539 pp., $7.75.)

Atomic Energy and its Applications

A simplified account of the fundamentals of nuclear science and its present and potential applications in medicine, science, and industry. Written by J. M. A. Lenihan for specialists in other fields, the book assumes a knowledge of college physics. References for further study are given at the end of each chapter. (Pitman Publishing Corporation, 2 West 45th St., New York 19, N.Y., 1954. 265 pp., $4.)

Bibliographic Survey of Corrosion, 1948–1949

This comprehensive bibliography of 3500 abstracts, compiled from various abstracting services and a wide range of specialized indexes, is arranged according to the NACE classification. The items are listed under eight major divisions: general, testing, corrosion phenomena, corrosive environments, preventive measures, materials, equipment, and industries. Subject and author indexes are provided. (National Association of Corrosion Engineers, 1061 M & M Building, Houston 2, Tex., 1954. 346 pp., $12.50; members $10.00.)

Data Book for Civil Engineers
Volume III: Field Practice

Provides the field engineer with essential data for inspection and supervision of virtually all types of civil engineering work. It contains check lists and procedures for inspection for concrete, masonry, structural steel, welding, bridges, soils, pipe laying, etc. A section on construction surveying has been added, tables and other data have been brought up to date and considerable new material is included in this revision. Elwyn E. Seelye is the author. (John Wiley and Sons, Inc., 440 Fourth Ave., N.Y., second edition, 1954. 394 pp. $17.50.)

Handbook of Building Terms and Definitions

A dictionary of some eight to ten thousand terms current in architecture, carpentry, drafting, electrical construction, masonry, painting and decorating, and plumbing and metal trades, by Herbert R. Waugh and Nelson L. Burbank. Pronunciation is indicated for difficult words, the trade or branch of industry in which a term is used is stated in many cases, and there are numerous illustrations. Architectural drafting symbols, geometric figures, pipe-fittings, and plumbing symbols are given in an appendix. (Simons-Boardman Publishing Corp., 30 Church St., New York 7, N.Y., 1954. 421 pp., $5.00.)

(*Continued on page 98*)

Recent Books

(*Continued from page 97*)

Highway Engineering

A text for junior and senior courses and a summary of new developments for practicing engineers with emphasis on design and its underlying principles rather than on construction practices. The subjects of highway planning, surveys, costs, finance, and legal questions on rights of way are considered as well as design, drainage, soils, and construction of highways with various surfaces. The authors are Laurence I. Hewes and Clarkson H. Oglesby. (John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y., 1954. 628 pp., $8.)

Materials of Construction

This is a revision of the textbook, by M. O. Withey and G. W. Washa, published in 1939, which was based on Johnson's standard work of the same title. It covers sources, manufacture, and fabrication of materials; data on mechanical and physical properties; causes of defects and variations; testing methods; and general uses. A new chapter on concrete aggregates has been added and most of the other chapters have been rewritten or extensively revised. (John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N.Y., 1954. Various pagings, $9.)

Mean Roughness Coefficient in Open Channels with Different Roughnesses of Bed and Side Walls

(Mitteilungen aus der Versuchsanstalt für Wasserbau und Erdbau an der E.T.Z., no. 27)

Records experiments with three channels of different shapes and roughnesses, made to verify the H. A. Einstein equation for the mean roughness coefficient or to find another equation of sufficient accuracy for field and laboratory experiments. Also considered by the author, Ahmed M. Yassin, is the problem of determining shearing stress on side walls and bed from the velocity distribution. (Verlag Leemann, Zürich. 90 pp., Sw. frs. $9.90.)

Metals Handbook, 1954 Supplement

In this first supplement new material is provided in fields in which the greatest advances have been made since the publication of the 1948 edition. Latest information on metals, alloys, and processes is compiled in twenty-four sections dealing with the selection of materials for various applications, design considerations, processing, and testing. Selected bibliographies are included in some sections by the editor, Taylor Lyman. (American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio, 1954. 184 pp., $5.)

Model Analysis of Structures

A discussion of the theory and techniques of selected methods for scale model analysis of structures with linear load-deflection characteristics. The author, T. N. Charlton, covers general considerations; the similarity principle; the indirect method and its application to the transverse portal frames of a power station; and direct methods and their application. Methods selected for treatment are those easiest to use with accuracy and speed with inexpensive tools or apparatus. (John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y., 1954. 142 pp., $5.)

Principles and Practice of Prestressed Concrete, Volume I

Coverage is similar to that of the previous edition: a brief history of the subject, various systems of prestressing and methods of tensioning, reports on tests, comparison of full and partial prestressing and detailed descriptions of practical applications of pre- and post-tensioning. Changes in notation and minor textual revisions and additions have been made by P. W. Abeles. The second volume will cover new developments. A note to the American reader gives A.C.I. equivalents of the notation used. (Crosby Lockwood & Sons, Ltd., London: Distributed in United States by Frederick Ungar Publishing Co., 105 East 24th St., New York; second revised edition 1952. 116 pp., $3.75.)

River Training and Bank Protection
The Sediment Problem

Flood Control Series, No. 4 and 5

The first of these reports discusses the theory and general principles of river training and bank control, describes methods used in different countries, including European and American, and makes recommendations based on comparisons of these methods. The second report covers transportation of sediment in streams and canals, silting and scouring of canals, silting of reservoirs, effects of sediment on the regime of rivers, and sampling and analysis. (United Nations Economic Commission for Asia and the Far East, Bangkok, Thailand, 1953. 100 pp., 92 pp., $.80, a piece.)

The Scientific Basis of Road Design

Roadmaker's Library, Volume XIV

The greater part of this book, by F. L. D. Wooltorton, is a study of soil properties, soil constants, and soil phenomena, including classification, chemistry and physics, electrochemistry, volume changes, and selection of materials. The last third covers design of subgrades and embankments, base courses, shoulders, and surface courses with their associated structures. Emphasis is on use of local soils for the construction of low-cost roads. References are listed after each chapter. (Edward Arnold, Ltd., London: Distributed in U.S. by St. Martin's Press, 103 Park Ave., New York 17, N.Y., 1954. 364 pp., $12.)

Simplified Site Engineering for Architects and Builders

The authors, Harry Parker and John W. MacGuire, explain in detail the solution of problems that arise in the analysis of building sites and in preparation of the site plan, including interpretation of deed descriptions, dimensioning when angles are other than right angles, computation of areas of irregular plots, dimensioning and laying out of circular curves for driveways, computation of volumes of cut and fill, etc. Problems requiring computations are accompanied with logarithmic computations shown in detail. (John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y., 1954. 250 pp., $5.)

Water Supply and Waste-Water Disposal

Treatment of the two subjects is integrated by the authors, Gordon M. Fair, John C. Geyer and John C. Morris, with the first half of the book devoted to the collection and removal of water and waste-water, and the second half to their treatment and to the natural purification of water. Emphasis is on principles rather than practice in dealing with sanitation; supply and disposal systems; ground water collection, transmission, and distribution; the biology of water and waste-water; methods of treatment and purification; and related topics. The book is intended for students and practicing engineers. (John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y., 1954. 973 pp., $15.)

The World's Great Bridges

Traces the development of bridge building from earliest times to the present. There are chapters on Roman bridges, the bridges of the Orient, and those built during the Middle Ages. About half the book covers the development of modern reinforced concrete, cantilever, steel arch, and suspension bridges. The book, by H. Shirley Smith, is written for both engineers and laymen. (Harper & Brothers, 49 East 33 St., New York 16, N.Y., 1953. 180 pp., $3.50.)

Applications for Admission to ASCE, October 16 – November 13

Applying for Member

Henry Aaron, Washington, D. C.
Ernest Cortland Adams, Kansas City, Mo.
Heyward Roberts Addison, Washington, D. C.
Edward Cecil Akerley, Cleveland, Ohio.
Harry Kenneth Anderson, Portland, Oreg.
Earl Raymond Andrew, Louisville, Ky.
Praxitelis Argyropoulos, Athens, Greece.
Henry Edward Bilodeau, Providence, R. I.
Marion Clifford Boyer, Iowa City, Iowa.
Robert Craig Brown, Knoxville, Tenn.
Richard Pierce Carlson, San Francisco, Calif.
Gilbert Meding Dorland, Nashville, Tenn.
Harold James Duffy, West Roxbury, Mass.
Thomas Edward Faley, Harrisburg, Pa.
Samuel Joshua Green, Baltimore, Md.
Stephen Haseltine, Boston, Mass.
Frank Clyde Houpt, Atlanta, Ga.
Robert Philip Howell, Greensboro, N. C.
Roy Elbert Hubb, Seattle, Wash.
Henry Marion Layne, Los Angeles, Calif.
Thomas Hourston McKaig, Buffalo, N. Y.
Cecil Durward Miller, Chicago, Ill.
Jagjit Singh Paul, Calcutta, India.
Albert Paul Pollman, Richland, Wash.
Joseph Rofman, New York, N. Y.
Louis Schwartz, New York, N. Y.
James Martin Slaughter, Meridan, Miss.
William Parvin Starr, Jr., New York, N. Y.
Harold William Stoeltino, South Bend, Ind.
Venkatrama Subramanian, Madras, South India.
Aubrey Monroe Tinder, Jr., Richmond, Va.
William Martin Turner, Jackson, Miss.
Charles Ronald Van Nest, San Francisco, Calif.
Robert J. Williams, Jr., Monterey Park, Calif.

Applying for Associate Member

Saaed Ahmed, Karachi, Pakistan.
Robert Maskell Bell, Oak Ridge, Tenn.
John William Bland, St. Louis, Mo.
Kenneth Arthur Buckland, Silver Bay, Minn.
William Joseph Bussells, Baltimore, Md.
Webster Black Carter, Jr., New Castle, Del.
James David Caufield, Portland, Oreg.
William Franklin Cothern, Mexico, D. F.
Franklin Theodore Emich, Reading, Pa.
Harry Otto Fischer, Jr., Fort Worth, Tex.
Karl Francis Gumnick, Middle River, Md.
Roy Page Hamman, Los Angeles, Calif.
Stanley Ira Hart, Pico, Calif.
Michael Arthur James, Norfolk, Va.
James Mack Johnson, Jr., Mobile, Ala.
Howard Lee Keller, Washington, D. C.
Joseph Merritt Lane, New York, N. Y.
Oscar Lehmann, Buenos Aires, Argentina.
Ernest Frank Masur, Chicago, Ill.
Richard Lawrence McKillip, Pittsburgh, Pa.
Edward Paul Micek, Rochester, N. Y.
Walter Niklaus Morgenthaler, New York, N. Y.
Arthur Raymond Munns, Kansas City, Kans.
Oscar Juan Pavot, Caracas, Venezuela.
Simon Peters, San Francisco, Calif.
Arjen Pietjou, Johannesburg, S. A.
Howard Malvern Post, Miami, Fla.
Robert McKinley Powell, Sacramento, Calif.
Robert Eldridge Rice, Abbeville, La.
Burke Valentine Hudson Rose, Cape Province, South Africa.
Paul Cook Sheridan, Marysville, Calif.
Shunta Shiraishi, Tokyo, Japan.
Oliver Bartley Sholders, San Diego, Calif.
Leon Thomas Silva, Albany, N. Y.
Edward John Stuber, San Francisco, Calif.
Frank Leon Szymborski, Knoxville, Tenn.
Bruno John Talvacchia, Oakland, Calif.
Ollie Kay Trammell, Washington, D. C.
Aquilino Alfredo Velasco, Buenos Aires, Argentina.
Stephen Hugh Wearne, Caracas, Venezuela.

Applying for Affiliate

Ernest Harry Spencer, Jr., Phoenix, Ariz.

Applying for Junior Member

Mohammed Ali Ansari, Beirut, Lebanon.
William Allen Ayer, Ontario, Calif.
Earl Ralph Cook, Raleigh, N. C.
Archie Augustus Davidson, Jr., Knoxville, Tenn.
Thomas Dudley Dismuke, Baltimore, Md.
Stanley Bernard Fishkoff, New York, N. Y.

(*Continued on page 102*)

Applications for Admission to ASCE

(*Continued from page 100*)

William Hamilton Groscup, Jr., Baltimore, Md.
Yves Henri Lacroix, Seine et Oise, France.
William George Lassiter, Jr., Aiken, S. C.
Pak-Fong Lee, Kowloon, Hong Kong.
Henry Hudson Myers, Jr., Baltimore, Md.
James Leo Murphy, Jr., Nashville, Tenn.
Donald Lawrence Paff, Oakland, Calif.
Harold Francis Perla, Los Angeles, Calif.
Lowell Alfred Rathbun, Bozeman, Mont.
Syed Ziaul Hassan Rizvi, Karachi, Pakistan.
Gerald Don Sjaastad, Lafayette, Ind.
Anibal Torres Giron, Lima, Peru.
Edward Allen Turner, Houston, Tex.
Courtney Moores Wright, Houston, Tex.

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[*Applications for Junior membership from ASCE Student Chapters are not listed.*]

Positions Announced

Corps of Engineers, Jacksonville District. The Jacksonville District currently needs Hydraulic Engineers (GS-9) at an annual salary of $5,060, in connection with planning and design of the Central and Southern Florida Flood Control Project. There are also openings with the District for Architectural, Civil, and Construction Engineers (GS-7 and GS-9) at $4,205 and $5,060 a year for military construction work at several locations in Florida. Information regarding these positions may be obtained from the District Engineer, Corps of Engineers, P. O. Box 4970, Jacksonville, Fla.

City of Los Angeles. An announcement of examinations for the post of Chief Harbor Engineer, at a salary of $1,236 to $1,539 a month, and Assistant Chief Harbor Engineer, at a salary of $755 to $940 a month. The examinations will be given on a nationwide basis and will be administered in locations throughout the United States as may be necessary. Information regarding requirements of candidates as well as application forms may be obtained by writing to the Civil Service Department, Room 5, City Hall, Los Angeles 12, Calif.

Orange County, California. Positions are now available with Orange County, California, for civil engineering graduates interested in obtaining generalized experience in flood control and highway work. The starting salary for the five-day-a-week position is $375 a month. For further information write to the Orange County Personnel Department, 644 North Broadway, Santa Ana, Calif., before December 31, 1954.

U. S. Civil Service Commission. There is a continuing need in federal service for Engineering Draftsmen (GS-2 to GS-11) at salaries ranging from $2,570 to $5,940 annually. No written test is required. Detailed information and application forms may be secured from the U. S. Civil Service Commission, Washington 25, D.C.

The Engineer Center, Fort Belvoir. The Engineer Center at Fort Belvoir, Va., announces the availability of an opening for the position of Civil Engineer (GS-9) at $5,060 a year. Application for federal employment, Standard Form 57, may be obtained from any Civil Service or Department of the Army Civilian Personnel office and may be presented in person or mailed to the Civilian Personnel Division, Employee Utilization Branch, Room 200A, Building 211, 21st St., The Engineer Center, Fort Belvoir, Va.

New York City Civil Service Commission. Applications for the position of Civil Engineering Draftsman, at a starting salary of $4,080 a year, are now being accepted by the New York City Civil Service Commission. Minimum requirements for this job are high school graduation and four years of drafting experience, or a baccalaureate degree in engineering, or an equivalent combination of training and experience. The applications are being issued and received in person and by mail from 9 a.m. to 4 p.m., November 5 to January 20, at the Department of Personnel, 96 Duane St., New York 7, N.Y. A request for an application by mail must be accompanied by a self-addressed, stamped (six cents), nine-inch envelope. A $3 fee must accompany the application at the time of filing.

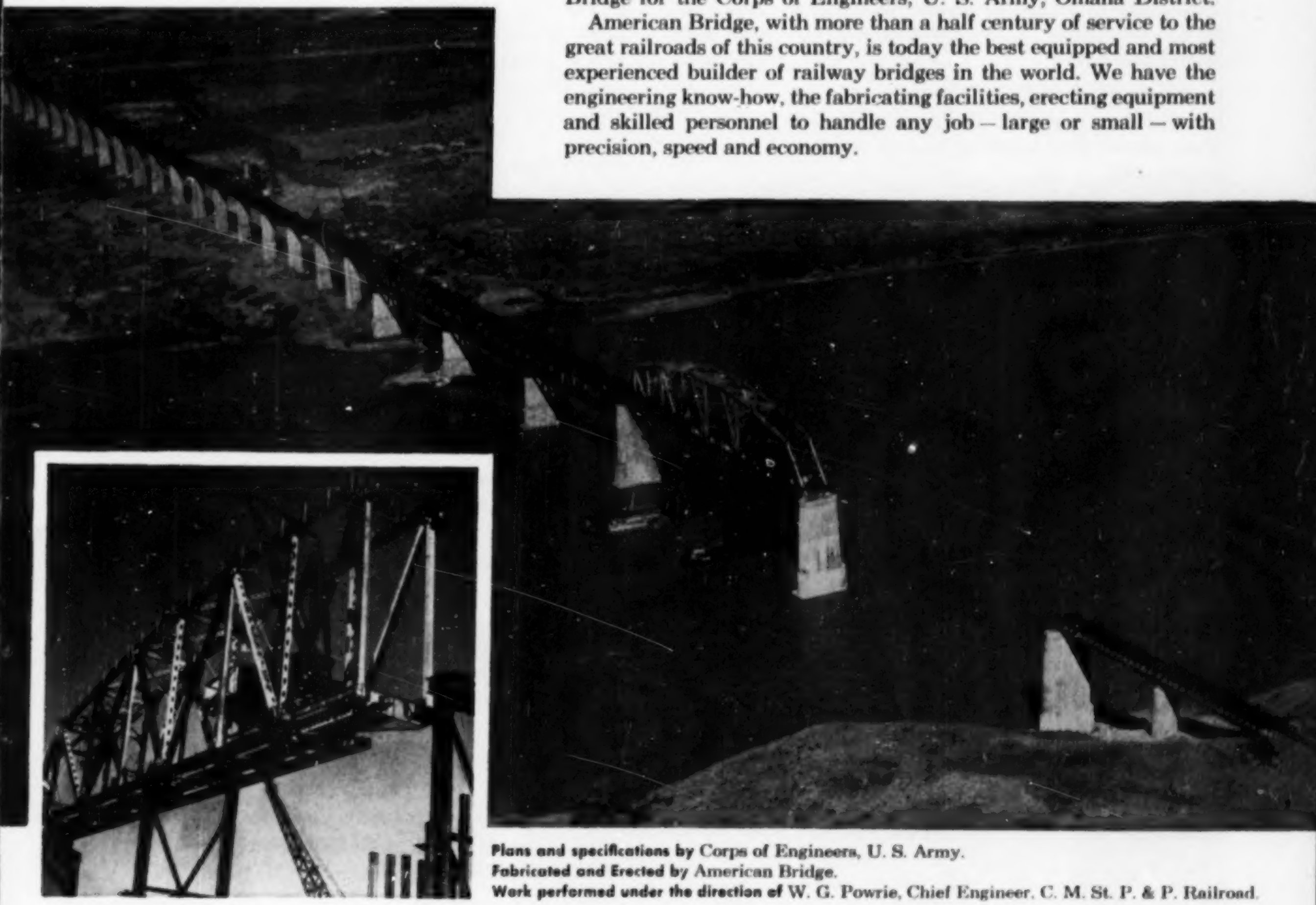
American Bridge builds 4,890-ft. bridge on CHICAGO MILWAUKEE ST. PAUL AND PACIFIC relocation project

New bridge over Missouri River has two 372-ft. through-truss spans.

This single track bridge over the Missouri River near Chamberlain, South Dakota, is part of the relocation of the C.M. St. P.&P. tracks made necessary by the construction of the Fort Randall Dam and Reservoir. It replaces the old bridge about 9,000-ft. upstream.

The 4,890-ft. structure features two 372-ft. through-truss spans over the main channel which provide a 42-ft. clearance above normal pool. The long bridge also has three 240′ deck truss spans, twenty-five 120′ deck plate girder spans, and four 98′ deck plate girder spans. Approximately 6,200 tons of structural steel went into the bridge, all of which was fabricated and erected by American Bridge for the Corps of Engineers, U. S. Army, Omaha District.

American Bridge, with more than a half century of service to the great railroads of this country, is today the best equipped and most experienced builder of railway bridges in the world. We have the engineering know-how, the fabricating facilities, erecting equipment and skilled personnel to handle any job — large or small — with precision, speed and economy.



Plans and specifications by Corps of Engineers, U. S. Army.
Fabricated and Erected by American Bridge.
Work performed under the direction of W. G. Powrie, Chief Engineer, C. M. St. P. & P. Railroad.

AMERICAN BRIDGE DIVISION, UNITED STATES STEEL CORPORATION, GENERAL OFFICES: 525 WILLIAM PENN PLACE, PITTSBURGH, PA.

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AMERICAN BRIDGE

USS

UNITED STATES STEEL

The Facts Behind Allis-Chalmers Leadership in Torque Converter Tractors

***Fourteen** years of experience . . . **eight** years with production models*
***. . . thousands** of torque converter tractors out in the field . . .*
***millions** of operating hours on every kind of work in the construction business.*

TODAY'S top contractors have given their "stamp of approval" to torque converter drive—as a key factor in the new standards of tractor performance they need for today's closely-bid jobs. Here's why —

Automatic Matching of speed and pull to load and terrain conditions . . . more dirt moved every hour, day in and day out.

Hydraulically cushioned protection for engine, clutch, transmission, rear end. The entire tractor lasts longer! That means less downtime, lower maintenance costs, more profit.

Operators love it! Allis-Chalmers torque converter tractors are so easy to handle (most shifting is eliminated) that operators do a top-notch job all day long.

Yes, the construction industry's most experienced men are demanding and buying torque converter tractors . . . *and in this, Allis-Chalmers leads the way.*

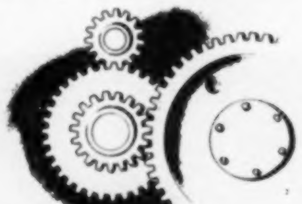
But, remember, you don't buy just one feature . . . you buy a *tractor*, with torque converter drive designed as a matched part of the entire machine. This advanced drive is only *one* of the many outstanding features that have switched so many leading contractors to Allis-Chalmers tractors. So . . .

Check all these features before you buy!

All-Steel Box-A Main Frame with one-piece, rear-end housing gives improved weight distribution, soaks up shocks, provides better equipment mounting, greater servicing ease . . . longer equipment life.

Service Simplicity of Unit Construction — Power drive components can be easily removed, repaired or replaced without disturbing adjacent parts . . . saving time and money.

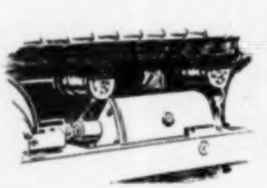
"Live" Sprocket Shafts — "Live" shafts with straddle-mounted bearings permit small, more serviceable seals. Double reduction final drives with smaller gears and shorter, heavier shafts mean extra ground clearance, better alignment, longer life.



1,000-Hour Lubrication — Tapered roller bearings and positive seals on truck wheels, idlers, support rollers and final drives extend lubrication intervals, cut downtime.

Hydraulic Booster Steering — Gives operator small tractor maneuverability with new ease. In addition, self-energizing brakes which take hold with a firm, uniform grip, provide exact control and sure safety with less pedal pressure.

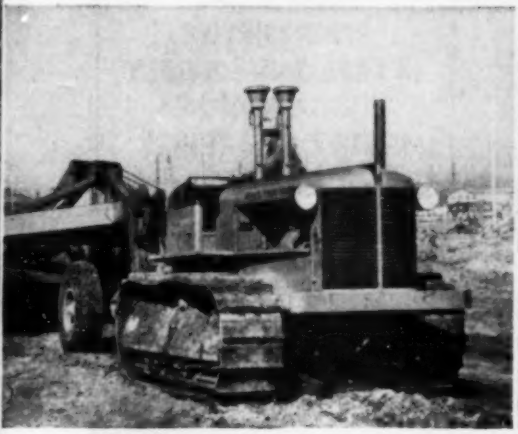
True-Dimension Track provides maximum ground contact . . . plus the right design, the best steels for every job condition . . . heat-treated for long life with the industry's newest, most complete facilities.



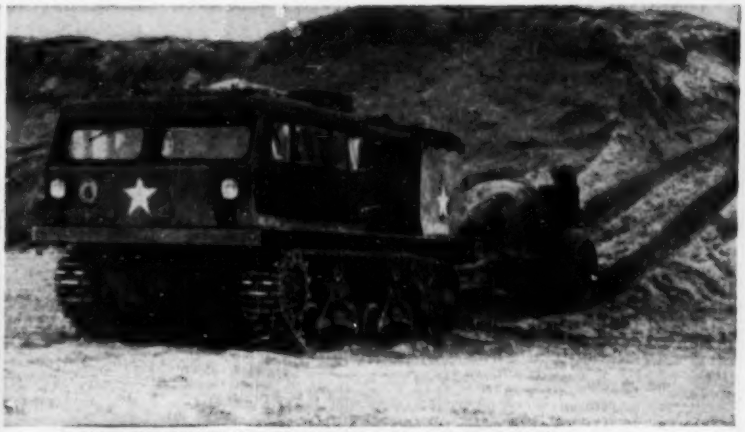
Oil-Enclosed Track Release Mechanism — Operates in oil, seals out dirt and moisture, always in working condition to provide positive protection.

See your nearby Allis-Chalmers dealer now for the full story. Whether you're interested in a big tractor like the HD-20 or HD-15 . . . or the smaller HD-9 and HD-5, you can be sure of getting the most advanced tractor in the business, because Allis-Chalmers is the leadership line.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.



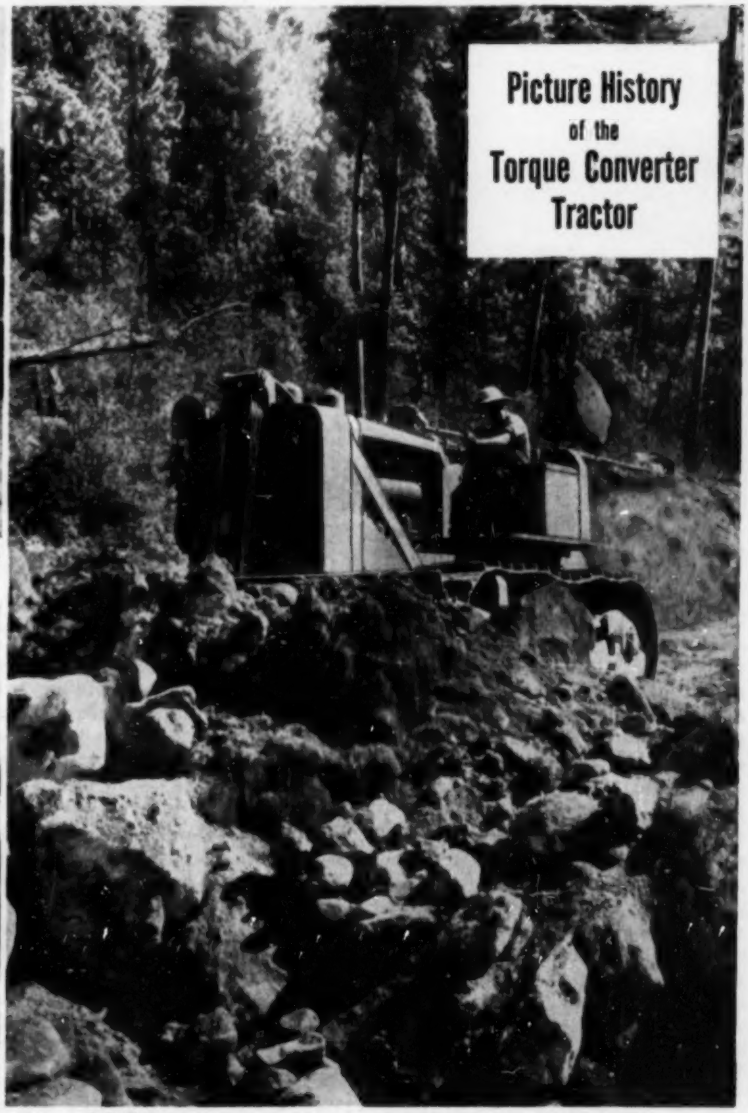
1940 THE FIRST tractor in the world with torque converter drive.



WORLD WAR II—The torque converter equipped M-4 military tractor, built by Allis-Chalmers.

1947 THE HD-19 proved the value of torque converter drive for big production.

Picture History of the Torque Converter Tractor



1954 THE HD-15C, 135 net engine hp, brings advantages of torque converter to a new range of work.

1951 THE HD-20, 175 net engine hp, most productive tractor in the business.

San Diego Convention of ASCE
U. S. Grant Hotel, San Diego, Calif., Feb. 7-12, 1955

Please fill in this form and mail to:
ASCE HOUSING COMMITTEE, San Diego Convention Bureau,
499 West Broadway, San Diego, Calif.

Name..
(*Please print*)
Address.................................City........................

Please reserve the following accommodations for me at the U. S. Grant Hotel:

No. of Rooms		Price Range
....Single Bed Room	at	....
....Double Bed Room	at	....
....Twin Bed Room	at	....
....Suite	at	....

I prefer accommodations reserved at:
Hotel or Motel...
Type accommodations.......................................

I will arrive..........; depart.......... I will be traveling by
(*date*) (*date*)
train...... auto...... plane...... bus......

To insure accommodations, all reservations must be received prior to January 23, 1955.

Advance information on attendance at San Diego Convention of ASCE

To:
R.S. Holmgren, Registration Chairman
235 Broadway, San Diego 1, Calif.

It is my plan to attend the San Diego Convention. I shall have......guests attending with me.

During the Convention I plan to attend the following events, tickets for which I shall purchase when I arrive and register:

Function	No. Tickets
Mon. Feb. 7	
Ladies' Luncheon in La Jolla	......
Tues. Feb. 8	
No Host Cocktails & Buffet Dinner	......
Wed. Feb. 9	
Membership Luncheon	......
Ladies' Zoo Trip	......
Thurs. Feb. 10	
Pacific Southwest Conference Luncheon	......
Ladies' Luncheon & Harbor Tour	......
Mexican Hat Dance (Dinner Dance)	......
Fri. Feb. 11	
Award Luncheon	......
Evening in Mexico	......
Sat. Feb. 12	
Field trips:	
Encina Steam Plant	......
Aircraft Carrier	......
Prestressed Girder	......

ENGINEERING SOCIETIES PERSONNEL SERVICE, INC.

NEW YORK	CHICAGO	DETROIT	SAN FRANCISCO
8 W. 40th ST.	84 E. RANDOLPH ST.	100 FARNSWORTH AVE.	57 POST ST.

This placement service is available to members of the Four Founder Societies. If placed as a result of these listings, the applicant agrees to pay a fee at rates listed by the service. These rates—established to maintain an efficient non-profit personnel service—are available upon request. The same rule for payment of fees applies to registrants who advertise in these columns. All applications should be addressed to the key numbers indicated and mailed to the New York Office. Please enclose six cents in postage to cover cost of mailing and return of application. A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription rate of $3.50 per quarter or $12 per annum, payable in advance.

Men Available

Civil Engineer; J. M. ASCE; 33; married; B.S.C.E., 1942; P. E. (N.J.): 10 years' diversified experience as engineer, superintendent and estimator in general and concrete construction of industrial plants, hospitals, warehouses, multistory apartments, bridges, and laboratories; desires permanent position with managerial responsibilities. Location preferred, New York Metropolitan area. C-4.

Civil Engineer, J. M. ASCE; B.S.C.E., 1945; 30; married; 8 years' responsible position as field erection engineer in industrial construction; desires permanent position with construction company or as plant engineer. Will relocate, preferably South or East Coast area. C-5.

Architect; J.M. ASCE; 31; married; registered Wisconsin and NCARB; B.S. and M.S. in architectural engineering, University of Illinois. Extensive experience in structural design such as a ten-story reinforced concrete hospital; also experienced in all phases of architecture. Location preferred, midwest or west. C-6.

Civil Engineer; J. M. ASCE; married; B.S.-C.E., 1949; 2 years' building construction, 3 year's industrial design and maintenance. Desires association with building contractor with opportunity to work into firm's management. C-7.

Construction Engineer; J. M. ASCE; 38; 15 years' experience in reinforced concrete building construction, airfield and highway construction, all types of excavation. Available as project engineer or field superintendent. Prefers east or foreign. Will travel. C-8.

Engineer; ASME and ASCE; 30; Reg. P.E.; broad experience in design, installation of vacuum and chemical process equipment, tablet and bushing presses, plant engineering and equipment development and research. Desires administrative or chief engineering position. Delaware Valley area. C-9.

Construction Engineer or Superintendent; A. M. ASCE; 48; married; 20 years' experience in highway, street, airport, sewer, water line and miscellaneous heavy construction at the supervisory and administrative level; 6 years' experience in pre-mix concrete business at the executive level. Have had special courses in business administration and concrete design. C-10-Detroit.

Positions Available

Construction Engineer, 30-35, who has had some experience laying pipe lines, preferably cast iron. The job would entail considerable traveling, supervising the installation of the company's product. Salary, to $10,000 a year. Location, East. W-229.

Research Engineer, 35-45, civil engineering graduate, who majored in structural design; master's degree desirable. Experienced in the theory and design of structural steel; ability to write technical reports and lead discussions. Must have the ability to speak informally at meetings. Design experience in the use of reinforced concrete and other structural materials. Location, New York, N.Y. W-312.

Instructor, primarily for foundation engineering and transportation courses at undergraduate level. Good facilities for personal and sponsored research are available. Salary open. Location, Delaware. W-319.

Field Editor, for national business publication in the civil engineering construction field. Engineering training, construction experience and writing aptitude essential. Will take own photographs. Salary, open. Headquarters, East; must be willing to travel. W-350.

District Engineers, 30-45, civil or architectural engineering education with structural steel design, fabricating and sales experience for sales promotion work. Considerable traveling. Salary, $7,500 a year. Location, Midwest. W-392.

Sales Engineer, 26-35, civil graduate, with concrete experience, for technical field work with customers of cement manufacturer. Salary, $4,800-$6,000 a year. W-453(*a*).

Junior Engineer with civil engineering training, to develop into concrete technician and assist sales and service engineers. Training period in eastern Pennsylvania with various locations in eastern and southern states available. Salary, $3,600-$4,800 a year. W-453(*b*).

Assistant City Planner, master's degree in city planning, civil, architectural engineering or social sciences, plus experience in city planning. Salary, up to $4,050 a year. Location, Connecticut. W-492.

Heavy Construction Engineers, young, graduate, civil, interested in field construction with above average academic records and a maximum of 5 years' experience for a long-range heavy construction program in eastern states. Initial training at home office, followed by field assignments. Applicants must be willing to relocate. Salary open. Location, Pennsylvania. W-513.

District Construction Manager, graduate engineer, with several years' experience in the mechanical and building phases of construction, to supervise and direct project superintendents on both building and mechanical type projects, including analysis of costs and methods. Experience as a district construction supervisor or project manager on several large projects desired. State salary required. Location, Midwest. W-519.

Structural Designer, for the design of complete project principally in connection with marine facilities of all types, major paper mill additions and alterations, fertilizer plants and other material handling problems. Thorough knowledge of the design of structures (steel, concrete and wood) and experience in accomodating mechanical installations into these structures. Location, South. W-526.

Sales Promotion Executive, 35-45, civil or mechanical graduate, with sales promotion and application engineering experience covering steel products for construction industry. Salary open. Location, Pa. W-545.

Structural Steel Estimator, with good technical and practical background in structural steel estimating. Experienced with other types of building materials desirable. Location, Pennsylvania. W-594.

Sanitary Engineer, 25-30, with a bachelor's degree in either civil or chemical engineering. Should have several years with a consulting engineer engaged in general field and office work. Must be capable of writing technical information as well as accurately appraising hydraulic designs of distribution systems and treatment plants. Will be employed in the sales promotional section of the company. Salary open. Location, Massachusetts. W-624.

Construction Engineer, 30-35, civil engineering graduate, with estimating and building construction experience, for office and field duties with institution. Must be able to write good reports. Salary, $6,500-$7,000 a year. Location, New York, N.Y. W-640.

TOWN ENGINEER, graduate civil, with New York State license, at least 5 years' experience in municipal, county or state engineering work. Will work on problems relating to town drainage, road construction, building construction, zoning and related activities. Salary, $5,500–$6,500 a year. Must be resident of New York State for at least one year. Location, upstate New York. W-666.

CONSTRUCTION INSPECTOR, familiar with steel bridges construction and concrete piers for railroad construction in Brazil. Must report single status. Eighteen months work. Salary open. F-685.

INSTRUCTOR, civil graduate, to teach mechanics of materials, graphic statics and hydraulics laboratory courses. Later, opportunity to teach in sanitary field. Starting February 1, 1955. Salary, $3,000 a year. Location, New York, N.Y. W-687.

SANITARY ENGINEER, C.E. or sanitary degree, with at least 5 years' experience in application or operating experience on sewage treatment equipment. Knowledge of sewage and waste treatment processes and practices. Duties will include: application work on sewage and waste treating equipment. Salary up to $7,500 per year. Employer will negotiate fee. Some traveling. Location: western Chicago suburb. C-2375.

Non-ASCE Meetings

American Association for the Advancement of Science. Meeting at the University of California, Berkeley, Dec. 27-30.

American Institute of Chemical Engineers. Annual meeting at the Statler Hotel, New York, N.Y., December 12-15. For further details contact Secretary Stephen L. Tyler, 25 W. 45th St.

American Road Builders' Association. The 1955 Highway Materials and Supplies Exhibit will be held in conjunction with the Association's annual meeting at the International Hall of the Roosevelt Hotel, New Orleans, La., Jan. 10-13. For details write to the American Road Builders' Association, World Center Building, Washington 6, D.C.

Chi Epsilon. Meeting of the New York Alumni Chapter in the Engineering Societies Building, Room 1101, January 5, 7:30 p.m., preceded by an informal dinner (at 6 p.m.) in the New York Times Dining Room, 11th floor, 229 West 43rd.

Fourth Conference on Scientific Manpower. The conference, sponsored by the National Science Foundation, the National Research Council, the Engineering Manpower Commission, the Scientific Manpower Commission, and Section M-Engineering of the American Association for the Advancement of Science, will be held in Berkeley, Calif., December 28-29, in conjunction with the annual meeting of the AAAS.

Highway Research Board. The 34th annual meeting of the Board will be held in the building of the National Academy of Sciences and the National Research Council, Washington, Jan. 11-14.

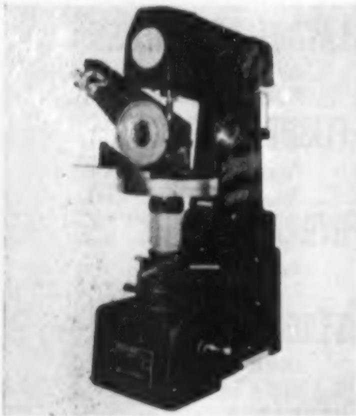
Society of Automotive Engineers. The Golden Anniversary Annual Meeting will take place at the Sheraton-Cadillac and Statler hotels, Detroit, Jan. 10-14.

EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Gear Testing Fixture

For accurate testing of gears on the pitch line of gear teeth a holding fixture has been announced. Designed for use on



Quick-Change Fixture

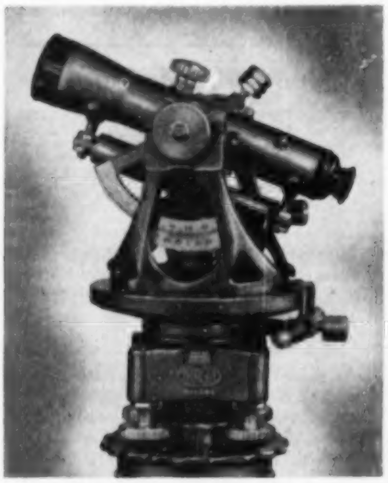
a Rockwell Superficial Hardness Tester with a special gooseneck type Brale, this quick-change device will accommodate gears of various sizes in either a laboratory or production operation. The gear is placed on an inclined plane mounted on a sliding plate; the plate is then moved toward a positioning anvil which is made to compensate for the diametrical pitch. The elevating screw is then raised to bring the Brale into contact with the gear tooth. A constant center line is maintained by a pivot screw. When the cam-type adjusting clamp locks the gear in position, the Brale is brought into actual contact with the gear, and the Rockwell hardness test cycle is performed. **American Chain & Cable Co. Inc., CE 12-110, 929 Connecticut Ave., Bridgeport 2, Conn.**

Building Cleaning Process

A building cleaning process which is said to remove accumulations of dirt and smoke without pitting or otherwise damaging the masonry surface has been developed. Known as the "Wet Aggregate" process, the new method consists of a gentle but effective "scouring" action, achieved by delivering water and an unique aggregate simultaneously through a special type nozzle at comparatively low pressure. The aggregate used is a mixed product, soft and friable, and possesses cleansing characteristics as effective as the traditional dry sandblasting, but without the latter's erosive effects. Because the aggregate is mild, it does not stain the building's surface. **Western Waterproofing Co., CE 12-110, 1223 Syndicate Trust Bldg., St. Louis 1, Mo.**

Transit-Level

Incorporating many of the advantages of construction and accuracy previously limited to the more expensive engineers' transits is the recent Model 65 builder's transit level. The new instrument features dustproof ballbearing center and telescope axis. Size variations of the balls do not exceed half a wave length of light. Model 65 operates freely at temperatures ranging from minus 70 degrees to plus 160 degrees Fahrenheit. The 8-in., 20-power telescope is completely sealed against dust and is resistant to



Model 65 Engineers' Transit

moisture-condensation; it may be tilted as much as 42 degrees up or down. **The Charles Bruning Company, CE 12-110, 4700 Montrose Ave., Chicago 41, Ill.**

Underwater TV Cameras

Two new underwater television cameras for use in important survey and salvage operations are now available. The portable Underwater Camera Chain is designed primarily to be carried down by a diver to the scene of investigation and positioned in accordance with telephonic instructions from the diving vessel. The chain consists of the camera, camera control unit, camera control power unit, remote control panel and synchronizing pulse generator. The picture from the camera is viewed on an 8-in. monitor in the camera control unit on the vessel. This hand-held underwater camera is 23 in. long and its diameter is $19^1/_2$ in. It weighs 85 lb. above water and only $1^1/_2$ lbs. when submerged. Designed for research down to 1,200 ft. **Bludworth Marine, CE 12-110, 92 Gold St., New York 38, N.Y.**

Electric Plaster Cutter

The new portable electric plaster cutter eliminates the practice of using a hand hammer and chisel to chip out plaster. Without cracking of plaster or wasting materials this tool makes parallel cuts in the plaster. The wheels may be set to cut grooves of different widths up to $1^1/_4$ in., while the depth of the cut may be regulated by adjustment of the wheel guard. The equipment consists of: the case, which contains a motor operating on AC or DC current; two 4 in. x $^5/_{32}$ in. x $^1/_2$ in. abrasive wheels with guard and handle; and the handle to which is attached a trigger switch and 15 ft of cord with plug-in for any outlet. The unit is $16^1/_2$ in. long and weighs 13 lbs. **Wodack Electric Tool Corp., CE 12-110, 4627 W. Huron St., Chicago 44, Ill.**

Microfilm Enlarger

An enlarger for 16 mm and 35 mm microfilm offers a brilliant and concentrated light source and a completely redesigned optical system. The "point" light source and the high resolution

16 mm & 35 mm Film Enlarger

Kodak Micro-File Ektar 63 mm lens project fine detail with increased sharpness and legibility at magnifications ranging from 4 to 45 diameters. Because of the "point" light printing is several times faster than in earlier models. Kodagraph Enlarger Model B features remote film transport and focus control. There is no need for a measuring tape since the image is focused visually on the copy board. For horizontal projection the Enlarger can be mounted on a wall or on a table. List price is $425. **Industrial Photographic Division, Eastman Kodak Company, CE 12-110, Rochester, N.Y.**

Equipment, Materials & Methods (Continued)

Hoists and Dump Bodies

A LINE OF telescopic hoists and matching dump bodies for use on tandem axel trucks has been announced. These hoist and body combinations are reputed to carry as much as 1,500 lbs. more legal payload on modern trucks of equal g.v.w. rating than can be carried by conventional bodies of similar size. Known as Duo-scopic Models 55381 and 66381, the hoists feature forward mounting of telescopic cylinders. This relocation of hoist cylinders, plus a new design of subframes, moves more body, hoist and load weight forward onto the truck's front axle. The hoist cylinders are equipped with self-adjusting aircraft-type chevron seals. Rated capacity of Model 55381 is 18 tons and of Model 66381 22 tons. Both are available in either center or outrigger type mounting to simplify installation on trucks of any make. **The Galion Allsteel Body Company, CE 12-111, Galion, Ohio.**

Telescopic Hoists

Pier-Anchor

TO MEET THE need for an easily installed screw piling a recently patented device called the EZY Pier-Anchor is now on the market. Either permanent or temporary installations require only a few minutes and offer high load resistance to both tension and compression. The EZY is of great value in reinforcing foundations where fill conditions are encountered as well as tie-downs of any nature. The EZY is used for guying structures such as outside elevators and all types of scaffolding. Equipped with a pointed steel body with tapered flanges, it pulls itself into position when turned and locks itself to the earth. The holding power of the EZY is increased by the screw's action of packing soil tightly around the blade as it descends. As a result of this action the surrounding soil is made more compact. Design of the blades will not allow any upward movement of soil but instead it is compressed to the sides and between the blades. The EZY is made in a wide range of sizes and can be turned to desired depth of penetration by adding extensions. The average operation takes only 5 to 10 minutes. **Van Dyke Industries, CE 12-111, 3625 Cahuenga Blvd., Los Angeles 28, Calif.**

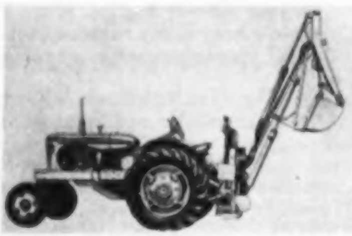
EQUIPMENT, MATERIALS and METHODS

A-C Welders

Consisting of NEMA rated 300, 400 and 500 amp models, a complete industrial line of low maintenance a-c welders is now in production. The new welders feature stepless current control, silicone insulation, aluminum coil windings, and are equipped with a large current scale, which the operator can read from a considerable distance without returning to the welder. Fingertip current adjustment and quieter operation are made possible by the way in which the coil supports float in a special rubber bushing. To obtain highly accurate current settings the welders utilize the moving primary coil design and a large current scale which has wider calibrations in the lower ranges. Wide current ranges enable them to be used on practically all industrial applications ranging from light-duty, low current, to heavy-duty, high current welding jobs. **General Electric Co., CE 12-112, Schenecady 5, N.Y.**

Wheel Tractor

Added to the line of excavating equipment is the Model WD-45 wheel tractor equipped with the Henry backhoe. Weighing approximately 4,000 lbs., the WD-45 is powered with a gasoline engine, a valve-in-head design unit developing 45 hp from a 226 cu. in. piston displacement, and a 6.5 to 1 compression ratio. The WD-45 has the versatility and power to do many smaller trenching and excavating jobs, as well as perform cleanup, maintenance and other work which could tieup costly, heavy-duty construction and maintenance



Model WD-45

equipment. Interchangeable attachments make possible quick conversion. Available attachment to the basic unit of tractor and backhoe include five buckets 16 to 24-in. wide, interchangeable with the backhoe for use in stockpiling, truck loading and other dirt moving jobs. Front-mounted attachments include the $^1/_3$ cu. yd front-end loader, a backfill blade, a lift fork, crane hook, and straight and angle dozers. **Allis-Chalmers Manufacturing Co., CE 12-112, Milwaukee 1, Wisconsin.**

Hole Cutting Machine

The mechanized mole, the new masonry hole cutting machine, uses a self-sharpening diamond drilling bit. This drilling bit cuts holes $^1/_2$ in. to 10 in. in diameter through hard aggregate and steel reinforcing bars to a depth of 18 in. Drilling time of a 6 in. diameter hole in one ft of concrete is less than two minutes. Other advantages of the Mechanized Mole are its ability to drill vertical or horizontal holes through any surface, its simplicity of operation, and its portability. The machine comes in both the one hp and two hp models. **Molco Drilling Machines Corp., CE 12-112, Washington, D.C.**

Super Hole-A-Matic

A new Hole-A-Matic which digs holes up to 16 in. in diameter is now being marketed. In a recent demonstration, it dug the hole for a twelve inch expanding plate anchor with a ten ft rod, in just eight minutes. Normally, this job takes two men and 35 to 40 minutes of digging time. The Super Hole-A-Matic also dug a diagonal hole for an eight in. expanding plate anchor with an eight ft rod in just 13 min. as against the two hours normally required for this type of installation. Previously,

(*Continued on page 113*)

Equipment, Materials & Methods (Continued)

this digging was done by hand, as until the introduction of the Super Hole-A-Matic, no earth boring machine would dig at an angle. For soil testing, tunneling, digging of concrete pier holes, pipe line installation, etc., it has in all tests proved more efficient, easier to operate and more versatile than other types of earth boring equipment. This machine is portable, fitting easily in a car trunk or on a light pick-up truck. Working with a pulverizing, grinding action, the Super Hole-A-Matic operates easily in all types of soil. **Multi-Matic Corporation, CE 12-113, Van Nuys, Calif.**

Vibrating Feeder

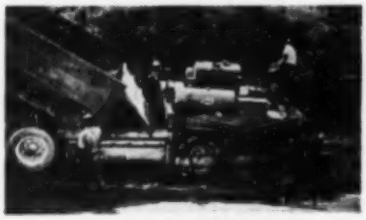
Although capable of capacities in excess of 300 tons per hour, the newly announced "Redi-Flow" vibrating feeder is still a light-weight, low-cost unit. This combination is achieved through the use of a simple, yet effective mechanical vibrating device. The "Redi-Flow" is made in 20 and 26 in. widths for feeding 24 and 30 in. belts. Lumps up to 12 in. in size can be handled, when mixed with fines, or to 8 in. maximum when the lumps are of uniform size. Capacity is dependent upon the size and type of material handled, but it averages 200 tons per hour for the 20 in. unit and 300 tons or more with the 26 in. unit. Sand, gravel, crushed stone, coal, slag and cinders are a few of the materials which have been handled with the "Redi-Flow." The "Redi-Flow" feeder is effective because the entire feeder and hopper are continuously vibrated by the eccentric action of counterweighted flywheels. This also makes accurate regulation of capacity possible by any of three means: by changing the weights on the flywheels, by altering the slope of the feeder itself, or by changing the amount of weight on the control gate. Of prime importance when frequent changes of material are necessary is "Redi-Flow's" self-cleaning feature. **Barber-Greene Co., CE 12-113, 400 No. Highland Ave., Aurora, Ill.**

"Redi-Flow" Feeder

Equipment, Materials & Methods (Continued)

Paver Finisher

A new paver finisher, which has been used in road paving for the state of Pennsylvania, features rubber tire mounting, hydraulically operated dual controls and a 4-cubic yd hopper. Of further interest to road contractors are the pneumatic traction wheels and the long wheel base for a better leveling action. Other design improvements of this model include the floating screed regulation by adjusting screws on either side and, set just ahead of the screed, two vibrating tamper bars. **The Blaw-Knox Company, CE 12-114, Farmers Bank Building, Pittsburgh, Pa.**



With 4-Cu Yard Hopper

Aluminum Siding

Designed to achieve more attractive, low cost siding on industrial buildings is a recent aluminum siding sheet. This new siding sheet is intended primarily for use on frame type structures, but it can also be used as a facing sheet on concrete block buildings. For application to the structural steel framework of industrial buildings, Widman fasteners, self-tapping screws, Nelson Rivweld studs and other conventional fasteners can be used. On old or new masonry structures the ribbed sheet can be applied with approved expansion type fasteners or with fasteners fired from powder-actuated guns. The ribbed sheets can easily be used for the popular "sandwich" wall construction. By using two layers of aluminum siding with a center layer of glass fiber insulation, a wall can be built with an insulation value equivalent to that of a 24-in. brick wall. The new siding sheet is available in .032 in. thickness and from 5 ft to 18 ft lengths in 6-in. increments. **Aluminnm Company of America, CE 12-114, 745 Alcoa Building, Pittsburgh 19, Pa.**

Concrete Moisture Controller

A moisture control system for concrete producing plants instantly measures and records the moisture in concrete aggregates for every batch of concrete. The equipment is offered by Instant Moisture Control, Div. of Colorado Pre-Mix Concrete Company.

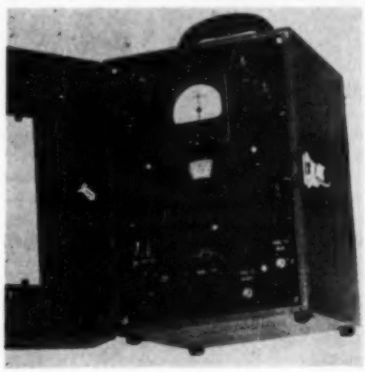
(*Continued on page 115*)

Equipment, Materials & Methods (Continued)

The installation of an IMC system makes it possible for the operator to tell at a glance the moisture content of the concrete aggregates and to adjust for it accordingly as each batch is made. In doing this the device takes only two to five seconds additional time to operate. The manufacturer, who is in the Concrete business, points out that the IMC equipment represents a major step forward in the production of quality concrete at lower cost. The equipment saves the cost of machinery, personnel and time used in adding water to dry loads to provide proper consistency. It also eliminates overly wet loads that are subsequently rejected and rerouted to other jobs or returned to the plant. **Pre-Mix Concrete Company, CE 12-115, 1021 West Mississippi Avenue, Denver 19, Colo.**

New Vibroground

To PERMIT A deeper exploration of the earth's substrata by electrical resistivity methods Model 274 Vibroground, a small instrument, has been developed from the designs of engineers and prospectors. The self-contained instrument uses the four electrode A. C. fall of potential method and reads resistance directly on a large, dial-type potentiometer calibrated to an accuracy of 1% of full scale. For maximum depth penetration a new low range of 0-0.4 ohms is incorporated with a complete series of resistance which ranges from 0 to 4000 ohms. Model 274 employs a dry-cell battery operated vibrator type power supply. Its measuring circuit is basically an A. C. bridge. Readings, independent of contact and lead resistance, are obtained by balancing a galvanometer type of null detector. **Associated Research, Inc., C. E. 12-115, 3758 W. Belmont Ave., Chicago, Ill.**



Model 274

Literature Available

Rotary Distributors for Trickling Filters—A new bulletin covering rotary distributors for trickling filters has just been released. Complete details of the Walker Rotoseal Distributors in sizes ranging to 216 in. maximum bed diameter are included. In addition the bulletin contains discussions and design data to assist in designing the complete trickling filter unit. Copies may be obtained by writing for bulletin 23S70 to **Walker Process Equipment Inc., CE 12-116, 840 N. Russell Ave., Aurora, Ill.**

Glossary & Classification Chart—The publication of a Hoist Classification Chart, compiled by an Engineering Committee has been announced. It has been published to provide a means of standardizing the capacity ratings and as a convenient method for comparison of hoists manufactured. The chart places all hoists in classes depending on the torque rating in inch-pounds developed by the hoist around its hinge shaft. Also included in the chart is a table for determining the size or rating of hoist needed for any anticipated use. Body dimensions and payload tonnage figures are used in the table which converts that information into the required hoist class needed for the given job. The HHSDBM Assocn. hopes to distribute the chart to all interested parties. Also compiled was a Glossary of terms used by the Industry. Copies of the Hoist Classification Chart and the Glossary are available from the association. J. R. Pat Gorman, Executive Secretary, **Hydraulic Hoist and Steel Dump Body Manufacturers Assocn., CE 12-116, 1740 "K" St., N. W., Washington 6, D.C.**

Tapping Concrete Pressure Pipes—A fully illustrated booklet on how to tap concrete pressure pipes has just been published. The pocket-size manual shows how to make large taps or small service connections under pressure quickly and at minimum cost. On-the-job photos and step-by-step instructions show how to tap prestressed concrete steel-cylinder pipe with ordinary tapping equipment without interruption in service. Copies of the manual may be obtained by writing to **Price Brothers Company, C. E. 12-116, 1932 East Monument Ave., Dayton 1, Ohio.**

Cooling Tower—"Cooling Water for Industry", a two-color, 36-page booklet, provides a description of induced-draft cooling tower construction. The bulletin, profusely illustrated with photographs, sketches, cutaway and exploded drawings showing the detail of structural and mechanical equipment, will be of particular interest to those with heat dissipation problems. The advantages of "Counterflo" design, methods of water distribution, and all components from basin to fan stack are described in detail. To obtain a copy of CT-ID-O, 002 ask **The Fluor Corp., Ltd., C. E. 12-116, Los Angeles 22, California.**

Literature Available (Continued)

Hydraulic Crane—An 8-page illustrated bulletin (AD-2253) has just been issued describing an indoor-outdoor Hydraulic Crane. Included with specifications and performance data are diagrams on working ranges, manual boom extensions, minimum aisle widths for turns. Attachments and special equipment are also described **Austin-Western Company, CE 12-117, 601 Farnsworth Ave., Aurora, Ill.**

Sound Control Products—To provide architects, engineers, builders and installers with information on sound control products an illustrated design data booklet has been published. "Fiberglas Sound Control Products" contains a selection guide which covers all products with condensed description and data on usage, installation, standard sizes, relative cost and noise reduction, fire resistance and light reflection qualities. Each product and installation system then is treated in greater detail in individual sections. The publication also has material on specifications and sound control concepts. Design Data AC6.A1. can be obtained from the **Owens-Corning Fiberglas Corporation, CE 12-117, Toledo 1, Ohio.**

Concrete Mixers—A 16-page pictorial catalog describing mechanical and application features of a line of modern volume production concrete mixers has been issued. These mixers fall into the 1 to 4 cubic yd capacity category and are used primarily in construction work for large dams, canals, buildings, as well as in commercial central and ready-mix concrete plants. Both the tilting and non-tilting types of construction mixers are discussed in the catalog. A breakdown of the structural features of each type mixer is also included. **Koehring Company, CE 12-117, Milwaukee 16, Wisconsin.**

Steel Shoring Equipment—Three types of steel shoring equipment designed to handle any concrete shoring job are described in a bulletin, "Modern Shoring for Concrete Construction". Featured is the "Trouble Saver" Sectional Shoring, a prefabricated shoring made up of welded steel sections that provide a scaffold within the shoring and a working level below the slab. Supplementing this article are engineering drawings, showing how a planned prefabricated shoring can cut costs, safe load charts, and photos of typical "Trouble Saver" installations. **The Patent Scaffolding Co., Inc., CE 12-117, 38-21 12th St., Long Island City 1, N.Y.**

Concrete Construction—As a guide to quality concrete construction, a few simple rules are set forth in a bulletin about sidewalks, driveways and steps. Covering the various phases of this type of construction, the eight page booklet discusses location and width, design, the subgrade, forms, materials, mixing and the other steps in the concrete construction process. **Portland Cement Association, CE 12-117, 33 W. Grand, Chicago 10, Ill.**

Literature Available (Continued)

Screening Equipment—Screening equipment for efficient removal of solids from water, sewage and industrial waste is described in a new 28-page book, No. 2587. It gives complete dimension and specification data for four types of coarse screens for removing large solids, and three types of fine screens for removal of small solids. Tables to determine the proper size unit for handling various capacities are given. The coarse screens are for installation at plants where the water contains heavy solids that might damage or clog equipment. They consist of a series of parallel bars in the flow channel, and the accumulated debris is removed by powered toothed rakes. Designed to remove smaller solids, the fine screens can be applied to prevent pollution of streams, recover valuable products or serve as water intake screens. Instead of bars, these devices use a relatively fine mesh screen cloth to collect the solids. **Link-Belt Company (Dept. 114), CE 12-118, 307 No. Michigan Ave., Chicago 1, Ill.**

Copper Sheeting—A recent bulletin explains some typical applications of a light-weight sheet of pure copper in heavy and residential construction. This thin sheet of copper, which weighs as little as one ounce to the sq ft, is pure electro deposit Anaconda Copper, reinforced with interlacing fibres and bonded to heavy creped kraft with special asphalt to prevent moisture penetration from the rear. The folder claims that this Copper Armored Sisalkraft can be used for all concealed flashing and waterproofing at 1/8 the cost of heavy copper sheets. **American Sisalkraft Corporation, CE 12-118, 205 West Wacker Dr., Chicago 6, Ill.**

Glass Blocks—"Skytrol Glass Blocks for Toplighting your Buildings," an eight-page catalog, has been prepared as a reference manual for engineers, architects and construction people. Skytrol glass blocks are of special optical design for use in skylights. They have double the insulating value of ordinary skylights, making possible temperature control within the building. Condensation problems usually encountered with ordinary skylights are practically eliminated. Information on physical performance, technical data on light transmission, insulation values, installation detail drawings, and complete specifications are fully covered in the booklet. **The Pittsburgh Corning Corporation, CE 12-118, One Gateway Center, Pittsburgh 22, Pa.**

Plant and Equipment Maintenance—A new edition of "Good Operating Practices," an illustrated 12-page brochure, contains 101 suggestions for maintaining plant buildings and equipment. It contains the latest recommendations for getting the best service out of insulations, packings, refractory products, roofings and friction materials. **Johns-Manville, CE 12-118, 22 East 40th St., New York 16, N.Y.**

PROCEEDINGS AVAILABLE

The following papers have become available as Proceedings-Separates. Following the date of issue of a paper, discussions thereof will be received for a period of three months, as specified on the cover of the paper. Titles will be added to this list every month, as they become available. Technical Division sponsorship is indicated by an abbreviation at the end of each item, the symbols referring to: Air Transport (AT), City Planning (CP), Construction (CO), Engineering Mechanics (EM), Highway (HW), Hydraulics (HY), Irrigation and Drainage (IR), Power (PO), Sanitary Engineering (SA), Soil Mechanics and Foundations (SM), Structural (ST), Surveying and Mapping (SU), and Waterways (WW) divisions. Papers issued prior to, and including, Separate No. 289, were not distributed under the present automatic mailing system. If you have not registered in a Technical Division to receive its papers (one Division only) free of charge, please do so promptly by filling out and mailing the enrollment and subscription form (page 121) to Society Headquarters. For ordering separate papers, use the convenient order form on page 120.

November

534. The Box Inlet Drop Spillway and its Outlet, by Fred W. Blaisdell and Charles A. Donnelly. (HY) The paper reports on model experiments made to determine the free flow capacity and the effect of submergence on flow over box inlet drop spillways; the development of an outlet for the spillway is described. For the use of the designer, data are presented to determine both the free flow capacity and the hydraulic proportions of the outlet structure. The geometric effects are described, and the corrections which must be applied to the discharge coefficient are evaluated for a wide range of conditions.

535. Diversion Flow Through Buford Dam Conduits, by Francis F. Escoffier. (HY) The Buford sluice and penstocks will be used to divert the Chattahoochee River during the construction of the dam. These conduits will flow partly full during most of the diversion period. A graphical method is outlined to show how the transition takes place from part-full flow to pressure flow in the conduits.

536. The Log-Probability Law and its Engineering Applications, by Ven Te Chow. (HY) The logarithmic-probability law of statistical distribution is increasingly applicable to various engineering data. This paper presents a comprehensive survey of early studies and practical applications, a theoretical interpretation of the law and the derivation of its characteristic values, computation of the frequency factor and a revision of Hazen's Table, verification of the fact that the extreme-value law is a special case of the log-probability law, and a suggested procedure of using this law with engineering data. Special emphasis is placed on the application of the law to hydrologic data.

537. The Economics of Paralleling Pipe, by George A. Whetstone. (HY) In the design of high-head hydroelectric developments and in other engineering applications involving large pipe carrying high pressures, the question often arises as to the relative economy of one large pipe or several smaller pipes. The paper compares the relative total weights of material and the relative diameters for equal pipe stresses in systems of 1, 2, 3, 4, or 5 pipes in parallel. Consideration is given to the differences resulting from the regime of flow.

538. Discussion of Proceedings-Separates 197, 230, 274, 354, 362, 380, 413, 431, 433. (HY)

539. Frequency of Maximum Wind Speeds, by H. C. S. Thom. (ST) It is recognized that high wind speeds cannot be forecast from physical analysis and that wind speed is a statistical variable which is subject to the usual random fluctuations of such variables. The paper deals only with the climatological aspects of the problem of wind speeds; the actual choice of the design wind is left to the designer. The problem is resolved into (a) the choice of wind observation, (b) the determination of the function of this wind observation, and (c) the choice of the type of statistic for determining the design wind.

540. The Vibration of Steel Stacks, by Walter L. Dickey and Glenn B. Woodruff. (ST) Few of the many instances of excessive vibrations of self-supported steel stacks have been reported in technical literature. There are few data as to the magnitude of the forces produced by periodic vortex discharge or the damping properties of the stacks in absorbing the energy resulting from these periodic forces. The authors analyze the data they have been able to accumulate and give tentative values for those unknowns which appear to be in the right order.

541. Resonant Vibration of Steel Stacks, by E. A. Dockstader, W. F. Swiger, and Emory Ireland. (ST) Shortly after their completion, the steel stacks of Moss Landing Steam Plant were excited to violent vibrational movement by a steady wind of moderate velocity. This occurred even though the stacks were capable of withstanding as a static force the drag from a wind of much greater velocity. Investigation indicated that vibration was caused by periodic forces developed during the formation of Karman Vortices in the air stream around the stacks. The paper discusses the character and magnitude of the disturbing aerodynamic forces, the studies made, and the design of corrective measures which will protect the stacks from future disturbance.

542. The Octagonal Girder Four Column Space Frame, by P. C. Disario, V. S. Podolen, and N. A. Weil. (ST) The paper presents the analysis of a pedestal consisting of a closed octagonal ring supported monolithically on four columns. A solution was obtained in closed form for uniformly distributed vertical load, concentrated horizontal (or shear) load, and linearly varying antisymmetrical (moment) loading. An approximate analysis is also presented which results in material simplifications of the functions involved in the moment expressions. Both types of analyses are accompanied by numerical examples.

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543. Design of the Chesapeake Bay Bridge, by R. A. Gilmore. (ST) A brief historical background of the bay crossing is presented. Also given are the channel clearances, principal dimensions of the structure, and design criteria. The various types of construction used in the substructure and superstructure are cited. The construction costs are totaled, and the method of financing these costs is described.

544. Examples of Timber Structures Failures, by Michael N. Salgo. (ST) A brief discussion is presented of the history of timber structures during the past 20 years, with particular emphasis on timber's part in the World War II construction program. A listing of the common causes of failure in timber structures is followed by a presentation of examples of timber-structure failures. It is concluded that a timber structure that is properly designed, constructed, and maintained, has its place as a major component in present-day construction.

545. Capitalizing on Municipal Waste by Composting, by Richard P. Stovroff. (SA) A general description is presented of a positve approach to the disposal of mixed municipal refuse. Values of the various component materials and the cost of processing them into organic fertilizer or salable scrap materials are discussed. An estimate, based on records from the operation of a large-scale pilot plant at Oakland, is given of capital requirements for such an installation in California.

546. Interrelation of Stream Regulation and Stream Pollution, by Charles M. Davidson and Milo A. Churchill. (SA) Large impoundments have both beneficial and deleterious effects on the quality of impounded and released waters—effects which are magnified if the inflowing water is seriously polluted. The hydraulics of flow through an impoundment strongly influences water quality. Thermal stratifications and density currents in the pools play major roles. Fluctuating discharges downstream pose problems in evaluating the capacity of the stream for adsorbing additional pollution.

547. Artificial Precipitation Control, by Ray K. Linsley. (SA) The possibility that man has learned to control and augment natural precipitation fascinates the engineer engaged in water supply and other hydraulic work. Such an advance would probably lead to major changes in hydraulic design practices. The paper surveys the theory and present status of precipitation control so that engineers may evaluate the current possibilities in this field of meteorology.

548. Foundation Treatment for Earth Dams on Rock, by Thomas F. Thompson. (SM) In the design and construction of earth-fill dams on rock foundations, attention must be given to possibilities of damage to the structure from high-velocity seepage as a result of reservoir heads. The paper outlines general principles of foundation preparation and describes the specific treatment used to correct foundation defects at several earth-fill dams constructed by the Corps of Engineers.

549. A Large Scale Field Shear Test on a Bentonite Seam, by S. T. Thorfinnson. (SM) A major problem in the design of the outlet works, spillway walls, and the spillway weir at Fort Randall Dam was the occurrence of numerous relatively weak bentonite and bentonitic clay seams in the Niobrara chalk bedrock. The paper describes a large scale field test to evaluate the shear strength of these seams. The design of the test, the apparatus used, and the test procedure are described, and the results are presented.

550. Exploration Principles for Major Engineering Works, by W. R. Judd. (SM) The paper presents guiding principles for the formulation of exploration programs for various engineering structures. Design factors are discussed which affect the development of geologic investigations for a power plant. Similarly, basic principles for developing exploration programs for canals, water tunnels, and earth and concrete dams are stated.

551. Some Practical Aspects of Sand Drain Stabilization, by Stephen M. Olko. (SM) Sand drain stabilization of soils has increased in recent years because of the necessity of constructing highway and airfield embankments on unstable, compressible soils. The paper presents some practical aspects of sand drain design, installation, and field control.

552. Pollution of the Mississippi River Near New Orleans, by Frank W. MacDonald. (SA) The object of this study is to determine the degree of pollution of the Mississippi River as it reaches New Orleans and the effect on the quality of the water by wastes of the city that are discharged into the river. Bacteriological records of 1934 are reviewed and correlated with the variation in the stream flow. Results are compared with the water quality standards currently in use so as to determine the suitability of the Mississippi River water as a source of raw water supply for treatment plants and the suitability of present standards as a means of evaluating raw water supply quality.

553. Discussion of Proceedings-Separates 315, 325, 328, 385, 416, 417, 435. (SM)

554. Cooperation Between Industries and Regulatory Agencies, by John E. Kinney. (SA) Cooperation between industries and regulatory agencies in pollution abatement is demonstrated by the results of a joint effort to achieve economic protection of our water resources. The program in the Ohio Valley has been directed toward defining the scope of analytical procedures, determining the need for and the degree of treatment, and evaluating the physical and economic limitations on treatment methods.

555. Water Supply Problems, by Francis S. Friel. (SA) The industrial renaissance in the rapidly growing Delaware Valley is described. Of particular concern are the water-supply problems relating to this growth. Facts relating to the water uses in the valley are presented, and the diversion of water by New York City from the Delaware River Basin is discussed. The water supply situation in Philadelphia, Levittown, and Chester is described.

556. Composting and Grinding: Report of a Subcommittee of the Committee of Refuse Collection and Disposal of the Sanitary Engineering Division. (SA) The paper reviews the existing status of composting and garbage grinding in the United States. Economically, the composting of municipal refuse has not yet been put on a commercial basis; however, composting should be considered along with other methods in any engineering analysis of a waste-disposal problem. The review of grinding covers household grinders and central grinding stations and the effect on sewers and sewage-treatment plants. Typical installations are discussed, and the cost of operating grinders is analyzed.

557. State Activities and Fiscal Aspects: Report of a Subcommittee of the Committee on Refuse Collection and Disposal of the Sanitary Engineering Division. (SA) The report includes a discussion of state activities as related to submission of plans and state supervision of refuse collection and disposal activities; a tabulation is given of these state activities. The report condenses costs of refuse collection and disposal data supplied by four different areas in the United States.

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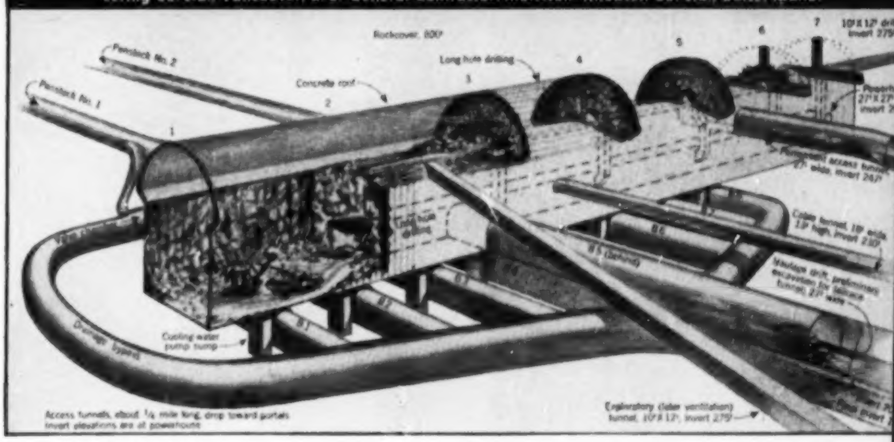

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